THE

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CONTENTS:

	PAGE
Patents	153
Elementary Theory of the Induction Alternating Motor (*illus.*)	156
Electricity on Common Roads	157
The Various Methods of Charging the Public for Electricity from a Central Station (*illustrated*) (*concluded*)	157
The Mensing Arc Lamp (*illustrated*)	159
A Ring Electro-magnet for Producing Intense Fields (*illus.*)	160
The Lighting of Public Streets and the Cost (*illustrated*)	160
The B. A. Presidential Address	162
The Boynton Bicycle Railroad	163
A New Woman and a Modern Alchemist	164
American Electro-Therapeutic Association	166
Legal:—The Cassel Gold Extracting Company *v.* The Cyanide Gold Recovery Syndicate (*continued*)	167
Woodhouse & Rawson United (*continued*)	169
On Electric Executions	170
Correspondence:—An Examination Question	171
Japan Cables	171
Electrical Distribution by Alternating Currents	171
The Physiological Effects of High Frequency High Potential Currents	171
Notes	171
Business Notices, &c.	175
Contracts Open and Closed	176
City Notes, &c.	176
Traffic Receipts	178
Share List of Electrical Companies	179
Reviews:—Journal of the Institution of Electrical Engineers	180
The London Matriculation Directory	180
The Practical Management of Dynamos and Motors	180
Electrical Apparatus for Amateurs	180
Electricity One Hundred Years Ago and To-day	181
Ministero delle Poste e dei Telegrafi	181
The Pacific Cable Outlay and Earnings	181
Proceedings of Societies:—Royal Society	183
New Patents	183
Abstracts of Published Specifications	183

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PATENTS.

THE discussion of the origin of the chloride storage battery by Mr. Andreoli, and his remarks on the patents granted at various times covering the whole or parts of the chloride of lead process for producing an improved plate, together with the evidence which we published last week on the litigation between the Cassel Gold Extracting Company, Limited, *v.* the Cyanide Gold Recovery Company and others, brings up the old question as to the examination of applications for patents by experts in the Patent Office, for the purpose of ascertaining whether the specification contains, first, any invention at all; secondly, whether the invention is new; thirdly, how much is new, and how much of it is old; and lastly, whether the claims made are wider than can be supported by the specification?

At the first glance it seems quite an easy matter to settle these questions, having experts with an ample reference library, and each skilled in his own department. In America such matters are submitted to the Patent Office Examiners before any application for a patent is granted, and we think no one who has had any experience in applying for American patents can say that the system of examination is an unmixed blessing. Take the first question, "Is there any invention disclosed in the specification?" However clever and conscientious an Examiner may be, he might easily make grave errors in judgment in answering such a question, for how often has it been before the higher courts, with the invariable verdict that though the amount of invention disclosed in a specification may be infinitely small, yet it is patentable. An Examiner may overlook a small amount of invention, and reject a valuable application.

This has happened often where examination is the law, and the case of the Bernstein application for a transformer patent is one in point. It was rejected by an American Examiner on the grounds that "a larger current could not be taken out of the transformer than was put into it." An Examiner's opinion is thus set up against an inventor's experience, with the result that a long correspondence ensues, practically for the sole purpose of educating the Examiner in the sciences and arts to which the invention relates, at the expense of the applicant. In some cases the Examiner is thus educated up to the point of perceiving the invention, and the application is granted so far; in other cases he does not see it, and the inventor may be compelled to appeal to a higher authority, or if poor, to drop his application altogether. Now of what avail is all this opposition to grant a patent to an applicant who has presumably made no invention. It could do no harm to grant him a patent; the patent would probably be worthless, and anyone feeling aggrieved at its existence could challenge it, and have the question as to whether it covered any invention decided before a judge, and with expert assistance. The injustice and mischief done by

refusing a patent where the smallest invention really exists, is infinitely greater than that which might arise from granting a score of patents to applicants with no inventions. Of course, applications which are made for patents for absurd inventions, such as perpetual motion, are rejected without examination; their title and aim offer sufficient evidence to condemn them.

In practice, again, the second question, whether the invention is new, is one which Examiners are apt to blunder over. In many cases the point as to what is an anticipation is a very difficult one to handle, and the Examiner frequently sets up as anticipations old proposals and inventions having no resemblance whatever to, and nothing in common with the invention under examination; and a mean advantage is often taken of this system of examination by powerful companies and firms to harass and oppose an applicant. It leaks out that an invention has been submitted for a patent, and the subject of the patent is also found out. An application is then made for a similar patent by the opponents—sometimes for several similar patents in different names. These are then put into "interference" with the original applicant, and then ensues a lengthy period of correspondence and delay, sometimes lasting four or five years before it is finally decided to whom the patent shall be granted. Meanwhile the wealthy and powerful applicants exploit the invention and derive much benefit from it, but this disreputable "interference" game could easily be stopped by making it law to grant the patent to the first applicant, the date of the application settling the question of priority as it does in this country.

The questions as to how much of an invention is new and the restriction of the claims, cannot be treated by Examiners with justice in every instance. Take the incandescent lamp cases on this side. The incandescent lamp was invented years and years before the Edison patent. The first man who conceived the idea of heating carbon up to incandescence in a vacuum inclosed in a glass bulb invented the lamp. This was done by Starr 40 years before Edison, but what was wanted in Edison's time was a method of making the carbon thin enough to work with a small current. Earlier inventors had realised this necessity, but it was left to Edison to discover how thin carbons could be made on a commercial scale. That was his invention, "a method of making carbons for incandescent lamps thinner than anybody had ever made them before." Yet in the law cases over this patent it was not a method of making thin carbons which was claimed, but the thin carbon itself, on the presumption that this inventor had been the first who ever thought of using thin carbons, which is absurd. Prior inventors had thought of, and desired to use, thin carbons, but did not know how to make them; Edison discovered how, and properly deserved every credit for it. But for our purpose it is a case which illustrates the difficulties of the Examiner in deciding what is new and what is old in an application. The valuable discovery given to the world was the method of making carbons. The patent was granted only for a thin carbon (and one judge added gratuitously "resilient" carbon) in a glass globe exhausted of air, a combination invented long before.

On every point we are satisfied that the British system is the best. Worthless patents may be plentifully granted, but we run no risks of refusing a patent to an inventor, who may be misunderstood or in advance of the times, or through the Examiner not understanding the subject. The worthless patents, as a rule, are harmless. Inventors have an opportunity of opposing the grant of any patent interfering with a prior one of their own during the opposition stage; but such opposition is not worth the trouble and costs; for, after all, the patent of prior date is master of the situation. The man with a good patent need not concern himself much about how many similar patents are granted after his, except to congratulate himself upon being the first applicant for an invention in such request. If an inventor on this side makes a careful search before completing his application, at the end of nine months he can make almost certain of ascertaining the novelty of his invention, and there are expert electrical engineers who have an intimate and accurate knowledge of what has been done in the past who may be consulted on the questions, so that a trustworthy examination may be had outside of the Patent Office without the dangers of officialism.

If an inventor chooses to proceed without these precautions, and obtains a worthless patent, he alone is the loser, and gets that which he deserves.

With the experience before us of those countries where the Examiner is omnipotent, we should indeed be sorry to see the proposal to introduce similar official examinations into our Patent Office system.

Electric Light Mains.

THE vexed question of the most suitable system of mains for various methods of electric lighting is one that before much more money is sunk underground should be thoroughly thrashed out—by, say, a Parliamentary Commission, in the same way that in 1861, a House of Commons Committee was appointed to enquire into the best form of cable, for purposes of recovery as well as of laying, under certain ocean depths. Electric light engineers would do well to take a leaf out of the book of experience of telegraph engineers who many years ago—when telegraphy was in the same primitive stage that electric lighting may be said to be just emerging from—tried almost every conceivable form of insulation before finally adopting gutta-percha and vulcanised India-rubber to the exclusion of any other materials or compounds of a less original cost. The basis on which India-rubber cables, as manufactured at Silvertown, Henley's, and Siemens's, have been adopted, for electric lighting or what not, is on the score of economy in maintenance, it being found wherever the mains have been of vulcanised rubber insulation that they have practically never required any further attention after being first laid down—and what other species of electric light main can this be said of, we would ask? The relative merits of India-rubber and gutta-percha as a means of insulation under different circumstances was somewhat fully illustrated in Mr. Charles Bright's report on subterranean telegraphs* in West Africa, to which we alluded in our issue of March 2nd, 1894, where the conditions varied between hard dry ground and ground that at a certain time of the year, at any rate, was more or less of a marsh, in other instances passing through alternating wet and dry conditions. A device of Mr. Bright's to ensure the protection of cable ends at uninhabited cable huts, described in his report, might also be turned to useful account for electric light junction boxes under certain circumstances. It is a pity that more such reports (not necessarily publicly published) do not similarly find their way to the library of the Institution, acting, as they do, as guides to similar workers in the same field.

* Report on Yof-Dakar underground cables and St. Louis beach cable, by Charles Bright, Assoc.M.Inst.C.E., M.I.E.E.

Telegraphic Communication by Induction by Means of Coils.

In a paper recently read before the Royal Society of Edinburgh, by Mr. C. A. Stevenson, the results are detailed of some experiments with the view of establishing communication between North Unst lighthouse, situated on Muckle Flugga, and the mainland, and thence to the lighthouse station at Burrafiord, a distance of two miles. A number of experiments were made in the laboratory to discover the laws of the action of coils on each other, with a view of calculating the number of wires, the diameter of coils, the number of ampères, and the resistance of the coils that would be necessary to communicate with Muckle Flugga, and after a careful investigation, it was evident that the gap of 800 yards could, with certainty, be bridged by a current of one ampère with coils of nine turns of No. 8 iron wire in each coil, the coils being 200 yards in diameter. It was found that 100 dry cells, with 1·2 ohms resistance each and 1·4 volts, gave good results, the observations being read with great ease in the secondary by means of two telephones. The cells were reduced in number down to 15, and messages could still easily be sent, the resistance of the primary being 24 ohms and the secondary 260 ohms. The hearing distance is said by Mr. Stevenson to be proportional to the $\sqrt{}$ of the diameter of one of the coils, or directly as the diameter of the two coils, so that, with any given number of ampères and number of turns to hear double the distance requires double the diameter of coils, or double the number of turns, and so on. But this is within certain limits, for when the coils are close to one another the law does not hold. With regard to the question whether or not the parallel wire system is actuated by induction or conduction, it will, Mr. Stevenson says, depend how the ends are earthed, or, in short, what is the distance bridged in comparison to the breadth of base, which predominates. Where the wires are long in comparison with the distance bridged, conduction will be the main working factor, but when the base is small, and the distance bridged is large in comparison, induction will be the main factor, and the number of turns then increases the effect.

Submarine Navigation: A Problem for Electrical Engineers.

All the maritime nations are concerned with, and we believe are studying, through the media of their "Admiralty officials," the problem of submarine navigation. It is considered that a navy equipped with vessels which can be propelled at any depth beneath the surface of the water will possess enormous powers of offence. France, Germany, Italy, Spain, Great Britain (of course), and even Turkey, are at present engaged with the greatest secrecy in endeavouring to produce a practicable form of submarine torpedo boat; but the problem has hitherto baffled them. It is true that some success attended the famous trials of the *Gymnote* in Toulon Harbour about two years ago, and it is claimed that the French have a boat, the *Gustave Zède*, which is capable of keeping up a speed of 14 knots for several hours below the surface of the sea; but these boats can hardly be said to have realised all the necessary conditions. From what we can gather, the key to the whole problem is in the hands of electrical engineers. Steam cannot be employed as a motive agent on account of the absolute impossibility of disposing of the products of combustion. Compressed air gives no better results, the weight of the chambers in which it must be stored proving too great; moreover, to dry the air thoroughly and the expansion of the necessarily enormous amount so lowers the temperature that ice forms in the pipes and renders them useless. Undoubtedly the direction in which progress and indeed success must be looked for is in electricity, more especially in the use of storage batteries. As yet, however, no system of accumulators has been discovered that is perfectly adapted to the needs of submarine navigation. Here, then, is a problem which those who are interested in secondary batteries may study, possibly with profit to themselves. The absolutely essential points are, extreme lightness, considerable storage capacity, and the absence of noxious gases at the moment of discharge. These must be borne in mind when entering upon a line of investigation. They are difficult points to reconcile amongst themselves, to say nothing of the conditions; but we venture to think that difficulty need not deter. If discouragement followed upon the recognition of the arduous nature of a problem, how few would ever have been solved by electrical engineers.

An Approximate Method of Finding the Forces Acting in Magnetic Circuits.

Prof. Threlfall contributes to the July number of the *Philosophical Magazine* an important paper on this subject which should be welcomed by everyone who has had, or is likely to have, occasion to design reciprocating electro-magnetic mechanisms. Such will have frequently experienced the need of some simple method of making the necessary approximate calculations of magnetic forces. Prof. Threlfall states that he has not obtained any satisfactory results in attempts to calculate tractions, proceeding by the method of finding poles and applying the law of inverse squares. This ill-success led him to investigate the applicability of the method established by Clerk Maxwell in the chapter "On Energy and Stress in the Magnetic Field" (*Electricity and Magnetism*, Vol. ii., sections 641—644). On these Prof. Threlfall bases his method. Maxwell's position is that magnetic forces may be regarded as the expression of stresses in the field, and, although it is a great step to pass from this to the position that magnetic forces are such an expression, this is done provisionally in the paper we are referring to, other additional hypotheses being laid down. To follow Prof. Threlfall through the lines of argument and experimental evidence which he employs to support his views would lead us into the absorption of more space in our journal than we are disposed to afford for such subjects. The paper is one that would suffer seriously by condensation, so that we must refer our readers to the original, where they will be able to study the curves and tables of experimental results with which the arguments are illustrated.

The Precipitation of Metals from Solution by an Electric Current.

A searching investigation into the separation of metals from their dilute solutions has recently been concluded by F. Mylius and O. Fromm. The experiments concerned the phenomena occurring in the precipitation of one metal by another as well as in the electrolysis of solutions. For the work as a whole we must refer our readers to the *Berichte der Deutschen Chemischen Gesellschaft*, xxvii., 1894, pp. 630—651. We give, however, the conclusions arrived at as regards precipitation by the electric current. They are as follows:—1. The heavy metals may be separated more or less easily from their dilute solutions in the form of black, porous, and apparently non-crystalline precipitates. 2. Silver and copper precipitated in this way may absorb or occlude hydrogen during the passage of the current, but the greater part of this gas escapes when the circuit is opened. 3. Silver and copper precipitates exhibit spontaneous change into the crystalline state, frequently accompanied by the evolution of hydrogen. 4. The conversion of the black into the crystalline modification is hastened by the action of metallic salts, acids, and oxidising agents, the metals in this respect being analogous to the alloys. 5. The black variety of copper containing hydrogen is essentially different from Wurtz's copper hydride. 6. An electrolytic method of formation of copper hydride no more exists than does a process of preparing the same body by means of zinc. 7. The black precipitate frequently observed on the zinc of a Daniell's cell consists of a copper-zinc alloy. The same substance separates and is deposited on the copper plate when the cell is exhausted.

ELEMENTARY THEORY OF THE INDUCTION ALTERNATING MOTOR.

By RANKIN KENNEDY.

I.

The present papers are attempts to give an explanation of the actions of the induction alternating motor without any mathematical illustrations. The explanation is based on a theory which is borne out by the actual facts ascertained by experiments with simple motors such as can be constructed for demonstration purposes.

Induction motors are of three kinds: single-phase, multiphase, and transformer motors. The transformer motor is a special form of multiphase motor at present not embraced in this theory; we shall therefore refer only to the single-phase and multiphase induction motors.

It is a remarkable fact now quite apparent to those who have followed the rise and progress of alternating motors, that if electricians had followed up the results of Arago's experiments with a rotating copper disc and a pivoted magnet, they would have discovered and developed the alternating motor, and two-phase and three-phase motors years ago; but instead of following Arago's disc and elucidating the induction effects therein, we have followed Faraday's disc experiments, and so the continuous current motor and dynamo first arrived at comparative perfection.

Let us take a copper disc, C, mounted on a spindle, and free to rotate in front of a laminated horse-shoe electro-magnet, M. As in fig. 1, which is merely a diagram, in practice the disc should be mounted between two such magnets, for if mounted in front of one magnet excited by an alternating current, the disc would be violently repelled in a line parallel to the shaft; with two magnets it is balanced between them.

Imagine our magnet excited by an alternating current, then in the disc secondary currents are induced, circulating in front of the poles in lines concentric with the poles as seen in C, the front view of the disc in fig. 1. Owing to the various lags between primary current and secondary current, these induced currents are really in the same direction as the current which induced them, but by the time they have reached full power, the succeeding reversed current in the magnet coils has also reached full power, so that the magnetism actually repels these induced currents, but the repulsion is equally strong one way as the other tangentially, so that no rotative motion is set up. The induced current is quite as strong on one side of the pole as on the other, but give the disc a smart twirl and at once off it starts and runs up to a considerable speed and exhibits power if a load is put on. How is this? Why does it run on after starting? The explanation is simple. Fig. 1, C, shows the induced currents circulating in

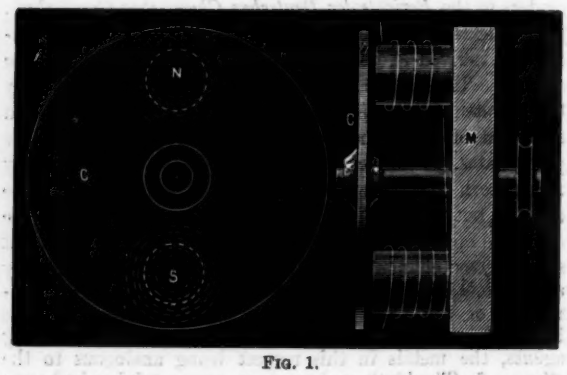


Fig. 1.

the stationary disc, concentric with the poles, having no more tendency to move one way or the other.

In fig. 1A, the disc has just been started in the direction of the arrows. Now the induced currents set up by the induction have been carried round by the motion during the interval of time between the induction and the formation of the induced current, so that when the next magnetic wave which repels the induced currents comes on, these currents are flowing eccentric to the poles, as seen in fig. 1A, and hence they are pushed much more forcibly one way than the other, and that in the direction of the motion given to the disc. It is this carrying round of the induced currents during the interval between the one + and the next — wave of magnetic flux and *vice versâ*, which causes the disc to go on rotating after once being set in motion; first we have a

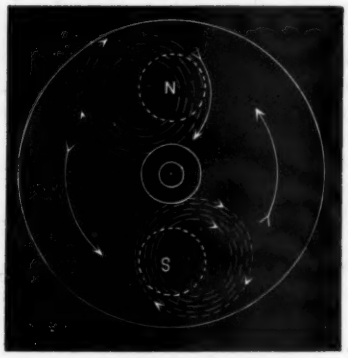


Fig. 1A.

flow of + magnetism then after a short time a flow of current in the copper disc, but by this time the disc has moved round and a — flow of magnetism begins just in time to give the induced current its full impulse forward, then another flow of current after another short time appears in the disc to be acted on by the following + magnetic flow and so on, the currents keeping an eccentric position to the poles owing to the disc moving round while the currents are forming, and being eccentric, they are propelled more one way than the other.

It matters not which direction the turning impulse is given, the action is the same.

On this principle, the single-phase induction alternating motors of C. E. L. Brown and Elihu Thomson are built. They require to be started by some extraneous means; small motors may be spun round by hand, or by a string like a a spinning top. Large motors are started as two-phase motors by splitting the current for a few moments.

A method of starting may be very instructively illustrated by the model here described, shown in fig. 2. If between

Fig. 2.

the disc, C, and the poles a piece of copper, shaped like that shown at S, S, be inserted, so as to half screen the poles, the disc will start off itself, because currents will now also be induced in the fixed copper blades which flow in the same direction and at the same time as those in the disc, so that the circular currents in the disc will cause the disc to turn in the endeavour to move under the fixed blades. It will be seen that the currents at *d*, *d*, and *d'*, *d'*, flow in the same direction and are therefore attractive.

The copper blades are made movable so that they are only used at the start up of the motor. In my next article the multiphase induction motor will be similarly treated.

ELECTRICITY ON COMMON ROADS.

The hopes cherished by some electricians as to the possibilities of electrical traction on ordinary railroads are not likely to be fulfilled by the adoption of any known system of electrical working. The most that can even reasonably be claimed for existing appliances, is the possibility of running a through train from point to point; but the general application of electric traction—involving the fitting up of station yards and branch lines—cannot be entertained by any sober thinking man, and even the partial application to through express passenger traffic is very improbable, for there is not much hope in any system involving a double motive power, electricity for a few special trains and steam for the remainder. There would be no money in such a double outlay.

There is, however, a field for the employment of electricity that appears to present certain possibilities of success and usefulness. We refer to its use on the common roads. Any objections that may be felt to the use of the overhead system in towns lose much of their force when the country roads are considered, and there are numerous good roads in the country where, by means of the overhead system, a very considerable traffic could be conducted between towns and villages or outlying places and the nearest railway. The very onerous charges made by the railways of this country for the carriage of farm produce has had the effect of very seriously curtailing the agricultural production of the country in favour of the foreigner, whose product is almost invariably carried by our own railroads for very much less than home produce.

So onerous have the railway charges become—notably on the South Eastern—that many market gardeners have, we are informed, ceased to use the line and have reverted to the roads, finding that, as compared with the railway charges, they can save both in time and money by doing so. That there must be a screw loose somewhere is evident. Horse traction has no right to be cheaper than steam traction on a railway, and, of course, would not be if railway directors used their brains. What we should like to see tried is an overhead electrical conductor along some main road to London that is travelled by the market gardeners' vans, such, for example, as the roads from Orpington. The farmers would bring their vans to the line at the home end and on arrival at the city boundary other horses would take off the vans to their destination, the miles between being covered by electric haulage. A suitable motor would be somewhat upon the lines of the present steam traction engine with the engine removed and an electric motor substituted. The current for such a line could very well be furnished by some existing electric light station, for the haulage is performed, we believe, in the early hours of the morning after the lights are out. The empty vehicles would be hauled back to the country as a day load, reaching home before dark, and thus being entirely a source of profit to a lighting station. Should such a scheme appear to contain the elements of success in its crude form, there is little doubt but that very shortly special motor vans would be built to replace the separate motor. A motor geared down to the axles of the van itself would involve none of the extra weight inseparable from the independent motor, while at the same time a loaded van would have ample tractive weight to draw after it other vehicles. Our English roads are so good that the traction upon them is by no means heavy, and we do not see any very inseparable difficulties in the way of realising such an idea. Farmers must have horses and so there would be no difficulty in bringing the loads up to the line any more than there now is in bringing loads to the railway. In many cases, too, there would be nothing to prevent a farmer having a conductor right into his farm when near the main line and so entirely dispensing with horse traction at the home end. Obviously, the first application of the idea would be upon roads leading out of the large cities some few miles only, but the rapid extension of electric lighting to towns along the roads offers such possibilities of relays that it would frequently happen that a pole line could be carried many miles without such a gap occurring as would demand a special generating station. The outlay on such a scheme would therefore be limited to the poles and conductors, and its financial possibilities would be favourable by reason of the fact that the only power required would come in as a day load and therefore serve to reduce the cost of the electric light stations fortunate enough to be called on to supply the current.

THE VARIOUS METHODS OF CHARGING THE PUBLIC FOR ELECTRICITY FROM A CENTRAL STATION.

By ALFRED H. GIBBINGS, A.I.E.E.,
Electrical Engineer to the Hull Corporation.

(*Concluded from page* 127.)

Notwithstanding much variety of complaint, the whole burden of the public grievance may be summed up in one word. The amount of the quarterly bills is the *fons et origo* of all dissatisfaction. It is much to be regretted that the consumer very rarely has even an approximate idea of the quantity of current which he is likely to consume, until after his first year's account has been made up. All the more important therefore is it that the supply companies should be awake to their own interests, and instead of including all consumers, large and small, under one imperfect system, should concern themselves in the adoption of some plan which would indisputably prove an equitable arrangement for each and all. Let us now consider what is the attitude of the public to each of the three existing methods.

Method No. 1 has the merit of being definite, and at the same time the demerit of being exceedingly unpopular. It is essentially the *small users'* system, under which this class of consumer reaps advantages equal to those of any other system yet devised. But for the consumer who uses a large quantity of current it is fatal, where the price per unit is anything above 5d. Therefore, until the number of small consumers becomes so great as to effectively reduce the price per unit to a reasonable and commercial figure, the adoption of the light by large consumers must be very limited.

Method No. 2, in all its forms, may be described as wanting in definiteness, that is to say, while inducements in the form of rebates are offered, the consumer is very much in the dark as to what abatement he will really reap, and what actual price per unit therefore he is paying for his electricity. This introduces an element of uncertainty which, to consumers, will savour much of a lottery, and the reputation of the supply company is sure to be adversely affected in many instances. Intending customers have to risk whether their consumption will entitle them to a reduction under the rules. This is undoubtedly due to the fact that the rebates are fixed upon the quarterly or annual consumption, which is intended to be an indication of the average quantity used per day. The arrangement is one-sided; satisfactory, that is, as far as the station is concerned, but unsatisfactory to the consumer, who never knows the actual price which he is paying for his commodity.

As regards Method No. 3, very little remains to be added to the remarks made in a previous section. If it were possible to apply this system so that daily instead of quarterly records were taken, the consumer would be treated fairly, and an equitable calculation of charges might be based on either the two hours per day consumption, or the maximum demand as registered on the indicator. This is not drifting into mere theoretical desiderata, but putting forward an ideally perfect method in order to arrive, if possible, at a practical solution of the whole question, which can only be attained by combining in one system all those desirable features which are alike fair to every consumer and to the supply company, and by eliminating as far as possible all the disadvantages which I have shown so far attach to existing methods.

Such an ideal method should embody the following points:—

1. The charges per unit should be definitely fixed for the supply of all electricity, irrespective of the amount of the consumer's demand.

2. All records should be based upon the *daily* consumption, and not upon the *quarterly* consumption.

3. The higher price should be charged only during the hours of maximum demand on the station, and the lower price at all other times.

4. The hours during which the higher price is charged should be definitely fixed, which period can be varied to meet the general lighting hours at different quarters in the year. These, for example, might be arranged thus:—

Two winter quarters from 4 p.m. to 7 p.m.
„ summer „ „ 6 p.m. to 9 p.m.

5. All consumers using current between the hours of, say, 4 p.m. to 7 p.m., should be charged the maximum price, and all consumers at other times the minimum price.

6. No rebates to be allowed to any consumer, all charges being based upon the net cost of production with a minimum of profit on every unit generated. All consumers necessarily benefit in this way in due proportion to each other.

7. One pair of leads from the supply mains should be arranged to carry all the current required, whether used for motive power or for lighting.

8. An automatic arrangement which would register all the current consumed at the higher price and the lower price, respectively, would be required in order that the foregoing conditions might be carried out.

It will now readily be seen that the above conditions do not in any way interfere with those rules and regulations of electricity supply companies which stipulate that the maximum amount of demand for supply shall be stated by the consumer, and that any additions to the installation shall be notified previous to use. On the other hand, the consumer under such a system as is sketched above, would know definitely that he could use the whole of his demand, at the lower price per unit, right up to the hour when the higher charge commences to take effect. Moreover, he would be sure of the rate at which he was being charged on any single day in the year, whether he intended to use a similar quantity on the morrow or not, and it is evident that being assured of this, the inducement to become a regular user would be greater than can ever be the case with the vague and indefinite inducement of a rebate at the end of a quarter, to say nothing of a rebate at the end of twelve months.

The ideal method would include all consumers, whether for lighting or for motive power, under one well-defined and equitable arrangement, and it must be acknowledged that, in any conception of commercial fairness and equity to both consumer and supply company, this method is the only one which meets every phase of the case. The public cannot be expected to become users of a commodity the price of which they do not know, or which labours under the disadvantage of complications not readily comprehended. But, without any doubt whatever, a great influx of patronage would accrue to the new energy if the absolute cost, according to probable requirements, could be calculated for any one at any time.

With reference, again, to the high peaks in the central station load curves, no system can do more to eliminate these than to charge the higher price at the period of maximum demand upon the station. The early lighting hours of the evening will always be the period of maximum demand upon the station, and however reduced the price may become in the future by reason of a large public demand, there will still remain the desirability, if not the necessity, to adopt some rational, that is, some simple and effective method, of charging for the supply.

The Ideal Arrangement.

Having reached the point to which, of course, all that goes before is merely preliminary, I now wish to introduce and explain an apparatus or arrangement, originally suggested by Mr. Kapp, and by which the adoption of such an ideal method as just described may be made practicable.

In my position one could scarcely help being constantly impressed with the necessity for something of the sort in the interests of all parties concerned. It is based upon the simple principle of shunting the meter. This shunt is automatically "opened" and "closed" at certain hours as approved, say, at 4 p.m. and 7 p.m. respectively. The apparatus must be placed in a closed box on the consumer's premises. The *modus operandi* will be better understood by reference to fig. 1.

The consumer's leads are shown going from the supply company's main fuse box, and in the positive lead is shown the usual meter. On each side of this meter is shown a terminal, to which is attached the shunt cable, broken at two little mercury cups. An automatic switch, S, connects these two cups at, say, 7 p.m., and thus completes the shunt circuit, the operation being reversed at, say, 4 p.m. the following day. The switch, which is nicely balanced, is actuated by a cam worked by a clock, C, which in turn goes with great accuracy for three months, and makes one revolution in 24 hours. The clock movement has been specially designed, and is controlled and rewound by means of two Leclanché cells, B. Figs. 2, 3, and 4 are drawings of the actual apparatus.

It is almost superfluous to describe the principle further,

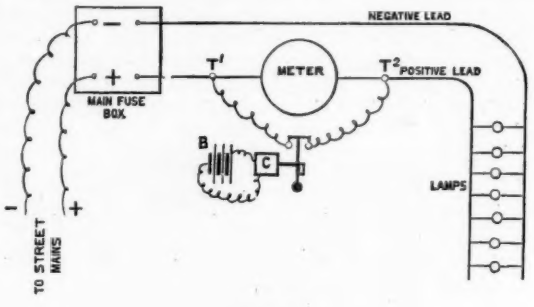


Fig. 1.

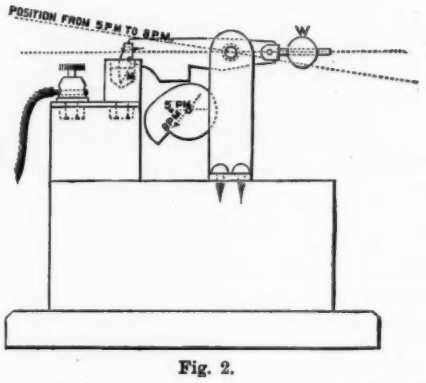


Fig. 2.

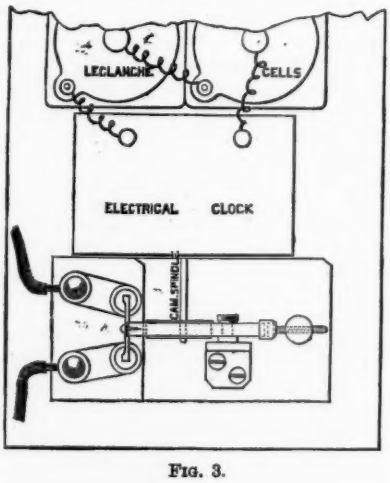


Fig. 3.

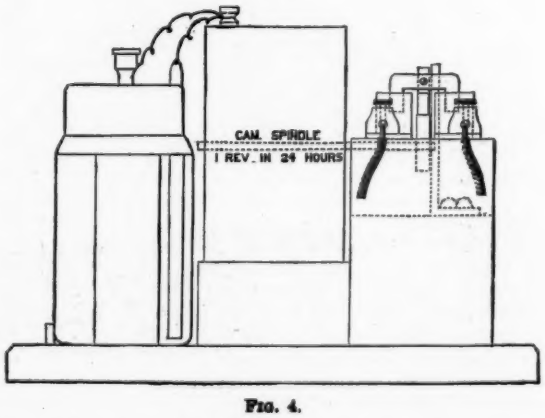


Fig. 4.

but I may remark that upon the ratio of the respective resistances of the meter and the shunt, between the terminals, T^1 and T^2, depend the rates of charging for current, as, of

course, when the *shunt* is "closed," the *meter* will only register the proportion of the current which is going through it, and when the shunt is "open," the registration will be at the full rate.

The ratio of the resistances can be determined in no more simple way than by means of an ampèremeter placed in the respective circuits alternately when the current is passing.

The action of this mechanism is perfect, and its time-keeping qualities are excellent. With a set of dry batteries, and attention once in three months by the meter inspector, the problem of dividing the charges for current appears to be solved.

Let me now enumerate some of the features which seem to me to constitute its chief credentials. This arrangement is entirely independent of any control from the central station. There is, therefore, no cost or trouble with controlling wires laid with the mains.

The arrangement can be used with any meter.

The calibration of the shunt will, of course, depend upon the ratio of the different prices per unit for current. Thus if the maximum and minimum prices are 6d. and 3d. respectively, the resistance of the shunt must be exactly equal to the resistance of the meter, in order that when the shunt circuit is closed by the switch, the amount of current passing through the meter will be half of the total amount in the circuit. But the shunt arrangement also lends itself to any other proportions of price, as 6d. and 4d., or 6½d. and 5d., which proportions are merely repeated in the adjustment of the shunt resistance. The adjustment for the calibration is easily and readily effected by lengthening or shortening the shunt wire, or by using a conductor of a greater or lesser sectional area. The total resistance of the meter being rarely more than ·003 ohm, it is evident that the adjustment necessary in respect to length of wire can only be a matter of a few inches. The calibration also, is effected with no less facility than, and of course at the same time as, the adjustment, as already pointed out. This operation can be determined in the meter department at the central station, the testing current being allowed to remain on for 5 or 10 minutes after the final adjustment has been made.

It will, moreover, be noted as a further instance of the way in which this system is easily applicable under all conditions, that it is quite independent of the actual prices charged, the *ratio* of prices being the only matter of consequence. So long as two charges are to be made, however little difference there may be between them, or however low the maximum price may be reduced, the arrangement will always hold good. The maintenance of Leclanché cells is a merely nominal figure, and the supervision and periodical examination necessary do not add any appreciable work to the duties of the meter inspector.

The original cost is a capital outlay of at most £3 per consumer, which is only half the price of the additional meter now employed, and it must also be borne in mind that there is no necessity to supply every consumer with the apparatus. Only those consumers who use the light for long hours should be the first to be supplied with the apparatus, such as hotels and public houses, newspaper offices, music halls, theatres, police and fire stations, restaurants, clubs, workrooms, public libraries, post and telegraph offices, bakeries, billiard rooms, technical schools, public lavatories, auction rooms, charging accumulators, &c., &c.

In conclusion, there is no need to point out how the electric light and electric motive power would be more extensively adopted, especially by such businesses and institutions as those just enumerated, if it could be definitely stated beyond all doubt, that the price for current would be 2½d., 3d., 4d., or 5d. per unit during the day and night, and 5d., 6d., or 7d. per unit for two or three hours in the evening, as the case might be, in any particular town.

I have now dealt with this subject in a somewhat exhaustive manner, or, at any rate, in very considerable detail, and I confidently commend Mr. Kapp's apparatus to the attention of all those who, in any way, theoretically or practically, are interested in the successful solution of this question.

Shoreditch Electric Lighting Order.—The Board of Trade have allowed the Vestry an extension of time of one year for carrying out their electric lighting order.

THE MENSING ARC LAMP.

This arc lamp, recently perfected by Mr. L. C. H. Mensing, belongs to the class of brake lamps, the feature of the invention being a large grooved brake wheel, A, in fig. 1. In this groove is stretched a German silver wire, *b*, *b'*, kept taut by a weighted lever, C.

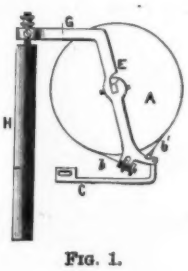


Fig. 1.

This lever is carried on a swinging stirrup, seen in fig. 2 at *d*.

The grooved pulley, A, and the cord pulley, F, carrying the upper carbon holder, are carried in a swinging frame, G, pivoted at E, and to which is attached the core of the solenoid, H.

The cord pulley and brake pulley are both loose on the spindle, but are connected by a ratchet wheel and clicket in the usual way, so that the cord wheel winds up the cord by means of a spring when the weight of the upper carbon holder is lifted up, but in the downward movement the clicket locks the cord and brake wheel together.

When current is passing, the stirrup, *d*, fig. 2, lets the weight on to the lever and the wire brake bites on to the wheel, because, when the solenoid pulls down, the frame swings out and the stirrup forward, thus lowering the weighted end of the brake lever. If the current weakens, the core rises, and the frame swings in, the stirrup lifts the weight, releases the brake, and lets the wheel slide, thus feeding the carbons together.

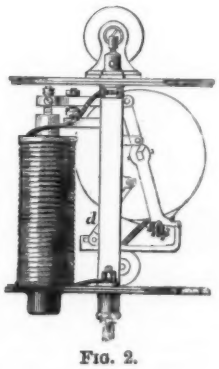


Fig. 2.

In fig. 3 will be seen the cord wheel, A, and the cord, C, clearly, also the brake lever stirrup and brake wire. This figure is taken from a photo of an 8-hour lamp which we recently saw tested on both an accumulator and an alternating current circuit, on both of which it behaved admirably; in fact, with extraordinarily good regulation. On the accumulator test, which is a severe one on any lamp, the pressure on the mains was 60 to 62 volts, and on the lamp terminals 44 volts on an average. The average variation of volts observed during a certain period, when readings were taken at short intervals, was over half a volt, and for long periods it was observed that the volts were steady, showing that the feed and the consumption were balanced exactly as they ought to be in theory.

On the alternating current tests the results were equally good. This test was made on a 50-volt secondary circuit from a large transformer, the terminal pressure at the lamp being about 34 volts on a Cardew instrument.

The design is exceedingly compact, giving a short lamp of

good appearance, and the mechanism is exceedingly simple and not likely to be easily thrown out of working order. It is intended to put them on the market at a very low price, so that a perfectly satisfactory lamp can be supplied at a price which cannot be called "fancy."

For working in parallel the lamps are made with a main solenoid only, and for series work are made with a shunt and main coil, or a shunt coil alone. When a shunt only is used, the core in fig. 1, H, is made to overbalance the frame and

Fig. 3.

pulleys, swinging on pivot E, and the core is let down into the coil, so that the shunt current pulls it up to swing the frame in and feed the carbons.

The cord suspension of the carbon holders has much to recommend it over sliding rods and racks, and this brake feed seems to be all that can be desired.

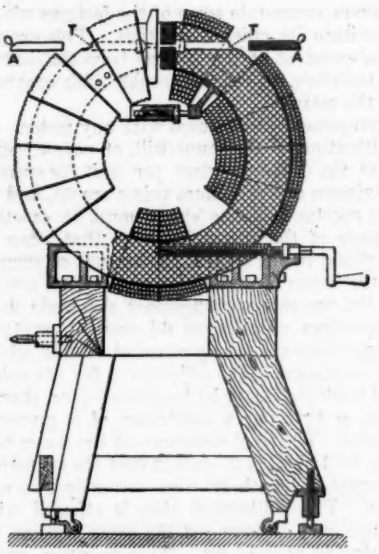
The lamp shown is not focussing, but it will be quite clear that it may easily be made so.

The lamps are of good design, and thoroughly well made mechanically and electrically, and we have no doubt they will work successfully on any circuit.

A RING ELECTRO-MAGNET FOR PRODUCING INTENSE FIELDS.

A short time ago we briefly noticed a new ring-shaped electro-magnet which has been devised by H. Du Bois for producing intense magnetic fields, and for employment in the study of the "Hall" and of magneto-optic phenomena, &c. We are now able to give a more extended account of it.

The apparatus consists of a ring of annealed soft iron of a mean diameter of 50 cm. There are 12 coils, each of 200 turns and embracing each a sector of 20°. They have a total resistance in series of 2·4 ohms, and are capable of carrying a current of 45 ampères, 108 volts. The magneto-motive force is thus 108,000 ampère turns, and the mean intensity of the field 860 C.G.S. units. 380 C.G.S. units go to produce the induction, and the remainder is used in resisting the demagnetising action; the intensity of magnetisation is 1,600 C.G.S. The maximum value of the coefficient of self-induction is 180 henrys, and the current takes an appreciable time to attain its definite value; for example, a current of 1 ampère only arrives at $\frac{9}{10}$ths of this value in about 17 seconds. Hence it is necessary to make and break current very gradually. A general view of the apparatus is shown in the figure.



The measurement of the magnetic field between the poles (which can attain 38,000 C.G.S. units) is effected by means of the method of the rotation of the plane of polarisation in water which can be placed in this space. A canal, T, perpendicular to the pole-piece permits of these measurements being made very easily. In most experiments, however, this canal would be stopped up by the rods A, A. The dispersion of the lines of force increases with the intensity of the current, passes its maximum at about 3 ampères, and then diminishes.

Very intense fields can be obtained, as everyone knows, by concentrating the lines of force by means of conical pole-pieces, for which theory indicates as the most favourable summit-angle 109°, but in reality the best results are got with a summit-angle of about 120°, as Ewing and Low have already proved. This is the angle selected by Du Bois for his pole-piece summits.

So far the apparatus has only been used for measuring the "Verdet constant" for a certain number of samples of glass of which the indices of refraction were known. Further details may be found by consulting *Wiedemann's Annalen*, LI., p. 537.

THE LIGHTING OF PUBLIC STREETS AND THE COST.

This article is merely an analysis of the concluding chapter in a work of the highest importance just published by M. Henri Maréchal, Engineer of Roads and Bridges and to the Municipal Service of the City of Paris, entitled "Lighting at Paris."* This book of 500 pages, filled with valuable

* "Lighting at Paris." Technical study of the various modes of lighting employed at Paris for the lighting of the streets, promenades, gardens, monuments, railway stations, theatres, large shops, &c., and in private houses; Gas, Electricity, Petroleum, Oil, &c. Works and Central Stations, Mains and Lighting Apparatus; Administrative and Commercial Organisation; Relations between the companies and the City; Contracts and Agreements; Calculation of the Lighting of the Public Streets; Cost. By Henri Maréchal, Engineer of Roads and Bridges and to the Municipal Service of the City of Paris. One volume, octavo, with 211 illustrations. Price, bound, 20 francs. Baudry & Cie, Paris.

information, should be in the hands of all interested in the subject of lighting, and if we were to make extracts of all that would be of interest to our readers, we should have to reproduce almost the whole of the 14 chapters into which it is divided. We will now, however, merely analyse the last, which relates to the lighting of the public streets, and into which the author has introduced many new and interesting considerations as to the manner in which the lighting of public streets should be studied, and the means by which the real cost of this lighting can be arrived at, taking into account the many complex factors that contribute to it.

Starting with the *decimal candle* as the unit of luminous intensity and with the 1 metre candle as the unit of lighting, the writer begins by establishing the conditions that the lights should fulfil in order to produce on the ground, which is assumed to be horizontal, as uniform an illumination as possible. He shows that in the case of a theoretical light giving the same luminous intensity in all directions, the illumination produced on the ground is, starting from a certain distance from the foot of the perpendicular passing through the light, greater in proportion as the light is higher. He then establishes the known relation between the height, h, and the distance, d, of lights placed at regular intervals, which gives for the maximum lighting at the intermediate point:

$$h = \frac{d}{\sqrt{2}} = .707\ d.$$

This formula gives heights which are practically too great, but at the same time it shows that the lights are always placed too low to satisfy the conditions under which the best result is realised.

With intense gas burners and recuperative lamps, the photometric curve of the light is no longer a circle of which the light is the centre, and we must take this into account in order to calculate the lighting at any point of the ground. This is the method proposed by the author for arriving at it in a simple manner. Let m, n

Fig. 1.—Diagram giving the Curve of Illumination of a Light on the Ground Starting from its Photometric Curve.

(fig. 1), be the photometric curve of the light, L. At a point, P, on the ground, a lighting, e, is produced.

$$e = \frac{L\,C}{L\,P^2}\cos\theta, \text{ and as } L\,P = \frac{h}{\cos\theta}$$

$$e = \frac{L\,C\cos^3\theta}{h^2}.$$

Let us draw through C the vertical line, C D, through point D a line parallel to L C, through C a perpendicular to C L, and through the point, R, where the parallel to L C, cuts the pependicular, L P, the vertical line, K R. We get: K R = D R cos θ; D R = D C cos θ; D C = L C cos θ; therefore,

$$K\,R = L\,C\cos^3\theta.$$

The lighting at the point, P, being equal to $\frac{K\,R}{h^2}$, is thus determined by a graphic representation. By choosing the scale so that $h^2 = 1$, the length of K R, represents exactly the value of e on this scale.

We thus obtain, by repeating a certain number of times the operation indicated above, the curve of lighting of a certain light *over a plane*, which curve is deduced from its photometric curve.

As an illustration, M. Maréchal shows what should be the photometric curve of a light placed at a height, h, and giving a uniform light over an indefinite plane. The conditions that should be fulfilled by the burners, the reflectors, the refractory globes and diffusers, &c., are those which tend to give the actual photometric curve the form most nearly approaching the theoretical form, the zone of action, be it understood, being limited, since, in a horizontal direction, the light should emit infinite radiations.

The study of the curve of lighting is extended to all the existing lighting apparatus; the butterfly burner, the intense burner, the recuperative burner, and the arc lamp with opaline globe (continuous current 10-ampère arc), according to the experiments made by M. de Nerville at the central electrical laboratory.

Fig. 2 represents the photometric curve of the 10-ampère

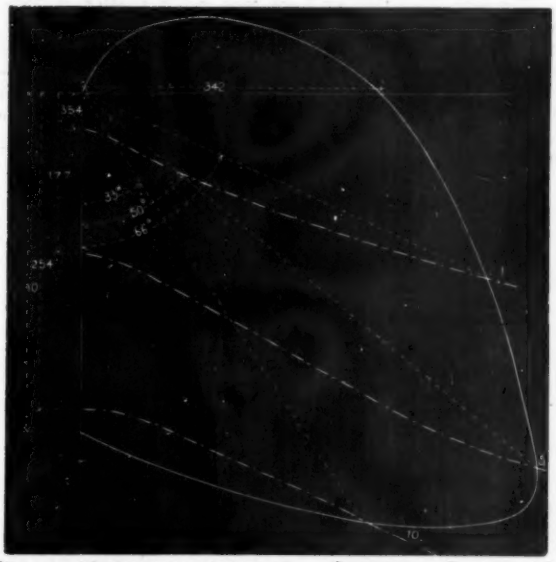


Fig. 2.—Photometric Curve of a Continuous Current 10-Ampere Arc Lamp with Opaline Globe. Photometric Curves giving for the same height of Burner (5·95 m.) uniform Lightings of 1·5 and 10 Candles per Metre.

lamp, and the corresponding photometric curves of a burner which would give a uniform lighting of 1·5, or 10 candles to 1 metre on a horizontal plane, placed at a distance of 5·95 metres, the usual height of the lights.

The lighting curves of each burner being once determined, it is easy to deduce from them the lighting at each point due to burners distributed over a given surface, over one, for instance, equal to the sum of the illuminations produced by each of the burners.

One fact observed simplifies the calculations. As photometric measurements admit of errors amounting to 10 per cent., it is useless to look for a closer approximation in the estimation of lighting, and, to find the total lighting at a certain point, we have only to consider the action of two or three candelabra. We thus determine the curves of equal lighting in a similar manner to the curves of level of topographical surfaces.

These curves, thanks to which we can also embrace at a glance the complete lighting of a street, enable us to calculate the mean plane of lighting; that is, the plane whose height above the soil will be such that its ordinate, multiplied by the surface of the street, shall be equal to the volume limited by the soil and the lighting surface.

Numerous examples of the lighting of the streets, avenues, and boulevards of Paris, are quoted as instances, and studied in detail. They enable us to establish, and this is the aim of the chapter and the book, the actual and comparative cost of the lighting produced under different conditions, taking into account all factors. The lighting of a street should be paid for according to the duration, the surface lighted, and the mean illumination, determined and defined as shown above.

To get convenient figures, each of these quantities should be measured in units of a suitable character. M. Maréchal

has chosen the hour as the unit of time, the arc as the unit of surface lighted, and the candle at 1 metre as the unit of luminous intensity.

The *lighting* is thus defined:

Lighting = Duration. Surface. Luminous intensity.

The corresponding practical unit =

1 hour. 1 arc. 1 candle at 1 metre.

The *price** of the lighting is therefore the quotient of the sum paid, or the cost by the lighting furnished. Taking the centime as the pecuniary unit, the price of the lighting will be expressed thus:

$$\frac{\text{centimes}}{\text{1 hour. 1 arc. 1 metre candle.}}$$

The definitions that we have just given modify in form only the corresponding definitions given by M. Maréchal, who uses the term éclairement for two essentially different quantities, one measured in 1 metre candles (an exact definition), the other in candles at 1 metre-arc-hour; for this latter quantity the term "éclairage" should be used. We will now give a table of lighting and its cost, drawn up by M. Maréchal, for the principal streets of Paris.

PRICE OF THE LIGHTING OF THE PUBLIC STREETS IN PARIS.

Kind of burners used.	Streets lighted.	Mean intensity in 1 metre candles.	Price of the lighting in centimes per hour-arc-candle at 1 metre.
Gas.			
Butterfly burner consuming 140 litres per hour.	Ordinary street 15 metres wide.	·12	6·81
Recuperative burner consuming 750 litres per hour.	Rue du Quatre-Septembre.	1·29	3·65
Arc Lamps.	Avenue de Clichy ...	2·22	1·62
	Large boulevards ...	3·35	1·29
Arc lamp of 10 ampères, with opaline globe.	Rue Royale, between the Place de la Concorde and the Rue St. Honoré.	3·40	1·83
	Rue Royale, between the Rue St. Honoré and the Place de la Madeline.	3·38	1·60

This table shows that under present conditions the large boulevards are the most economically lighted. The mean price of lighting by gas is 5·25, as against 1·58 for arc lighting. This last price would be still further reduced if, instead of paying 40 centimes per arc per hour, the city had only to pay 20 centimes per arc per hour, an abatement obtained by the municipal authorities for the lighting of the Parc Monceau.

These figures show in all cases that the lighting of the streets by means of butterfly burners is much too rudimentary a method, and that lighting by means of the voltaic arc is to be preferred, from an economical point of view, to lighting with gas, even with recuperative burners. We must await the result of the experiments undertaken with the Auer burner, before we express a final opinion as to the economic value of these burners for street lighting.

In any case, M. Maréchal's book places at our disposal the means of studying systematically and accurately the practical and economical value of the different modes of public lighting, and of expressing this value in figures. It is, therefore, worthy of a detailed description. We take this opportunity of thanking the author, who has given us permission to make any extracts required from his instructive and carefully-edited work.—E. HOSPITALIER (*L'Industrie Electrique*).

* We make an essential distinction between the price and the cost. The price is always specific, and relates to an object, to dimensions, durations, &c., whereas the cost is the sum total paid, and is always expressed in francs and centimes. For instance, the price of a certain piece of land is 200 francs per square metre; the cost of it is 200,000 francs. The term *cost price* is often used instead of *price*, and *price* instead of *cost*.

THE B. A. PRESIDENTIAL ADDRESS.

THE British Association for the Advancement of Science met this week at Oxford under the presidency and chancellorship of the Marquis of Salisbury. It is a comparatively rare thing to find in one individual the united qualities of a politician and scientist; there is no very apparent reason for the antipathy, but it seems to be the rule for science to be stranger to politics, and *vice versâ*. A politician, as such, has to cultivate a critical method of thought, and the exigencies of his work tend to develop those selective instincts which stamp the character of all great statesmen; he has further to learn the art of tempering his personal feelings to circumstances, allowing a broad margin for "expediency." Science, on the other hand, admits no such restrictions on the truth of things; it is the privilege of science always to speak out, just as it is an essential to politics to know when to be silent. There is evidently much virtue in a happy mixture of the two elements, for there is no doubt that while science aids in giving solidity and efficiency to political qualities, a political training calls into existence a keen and quick grasp of passing events, of the utmost value to a scientist. The subject of the inaugural address was to some extent a novel one. "Our Ignorance" is a topic of universal scope, and its survey constitutes the whole task of science. "We live in a small bright oasis of knowledge surrounded by a vast unexplored region of impenetrable mystery; from age to age the strenuous labour of successive generations wins a small strip from the desert, and pushes forward the boundary of knowledge. Of such triumphs we are justly proud. It is a less attractive task to turn our eyes to the undiscovered country which still remains to be won, to some of the stupendous problems of natural history which still defy our investigation."

The first phase contemplated of the riddle of "Our Ignorance" was the nature and origin of the elements; the metals and non-metals scattered hap-hazard over the globe with a relation to each other like the pebbles on a sea-shore, or the contents of a lumber room, and which all the alchemy of the Middle Ages, the atomic theories of Dalton, together with the elaborate analyses of modern chemists, had failed to explain, and had left without even a clue to the profound mystery; so that, notwithstanding the discoveries of spectrum analysis, we remain as ignorant as ever as to the nature of the capricious differences which separate the atoms from each other, and the cause to which those differences are due. The "periodic" law, as exemplified in the curious wheat-sheaf curves of Mendeléeff, were also passed in review, as showing that the elements could be divided into families, each characterised by a common resemblance as to its weight, volume, heat, and laws of combination; but greatly as this has added to our store of knowledge, it goes but a little way towards the solution of the problem which the elementary atoms have for centuries presented to mankind.

A second "ignorance" was pleaded on behalf of the ether; it could neither be described as a substance nor explained as an entity, and its only function seemed to be—the dog-tailed one—that it could "undulate." "Whether outside the influence of matter on the motion of its waves, ether has any effect upon matter, or matter upon it, is absolutely unknown; and even its solitary function of undulating ether performs in an abnormal fashion, which has caused infinite perplexity. The extended conception which enables us to recognise ethereal waves in the vibrations of electricity has added attraction to the study of those waves, but it carries its own difficulties with it. It is not easy to fit in the theory of electrical ether waves with the phenomena of positive and negative electricity, and as to the true significance and cause of those counteracting and complementary forces to which we give the provisional names of negative and positive, we know about as much now as Franklin knew a century and a half ago." This, we think, is a little too pessimistical; scientists do not mind owning to a comparative ignorance, but they ought to object to an ignorance which is on a dead level. The modern electrician certainly flies his kite better and higher than did Franklin; and although it is still only a kite, it is a greatly improved one.

The third "ignorance" is Life—animal and vegetable life—the action of an unknown force on ordinary matter, with some notes upon evolution and natural selection, in which the

President differs essentially from Darwin. There was nothing very striking in this part of the address. It is well known that natural selection is the weakest point in the evolution theory, and no one was so impressed by its weakness as Darwin himself. He, however, did not jump at once to conclusions of opposite character, but knowing that here the theory was somewhat elliptical, he sought to correct it by patient experiment—which, after all, is the only satisfactory weapon against all "Our Ignorance."

THE BOYNTON BICYCLE RAILROAD.

In our issue of August 3rd, page 141, we inserted a brief note of the above railroad. It is not very long since we had to comment upon another central rail scheme (Behr's), of which type the Boynton scheme is the most recent example. In that scheme, however, the idea was to run cars, suspended from an overhead rail, at an enormous velocity, and we were to be treated to a practical example in the shape of an actual line from Cannon Street to Waterloo, upon the South Eastern Railway. It occurred to us at the time that there was something singularly incongruous in the idea of trying a high speed electrical locomotive upon the South Eastern Railway. Can it be that the unfortunate association has been sufficient to upset the scheme, or is it that the practical difficulties to which we drew attention have made themselves so obvious, that it has been judged well to proceed no further?

The Boynton idea is very much on similar lines, but it differs in that the train runs upon a single rail laid upon the floor. In an ordinary two-rail-way the train is limited in its speed by certain practical considerations as to the danger of leaving the rail. Super-elevation of the outer rail is given at curves, but if this were made equal to the maximum speed, then slow trains would slide off the rail at the inside of the curve. Hence a moderate super-elevation is given—insufficient to derail the slow trains on the inside, and not enough for the fast trains, which are therefore moderated in speed when they are taking a curve, and thus it is that nothing very severe is felt by passengers in the way of centrifugal tendency, for the speed is reduced to fit the curve. In the centre rail idea of Behr, the carriage, when suspended, is supposed to fly outwards until it hangs in exact equilibrium, and passengers are merely caused to sit tight—not flung outwards. We showed the practical difficulties of this, and also pointed out the awkward results which would follow upon any attempt, by means of guide rails, to make the inclination of the cars other than what was proper for the speed and curvature.

It seems to us from the further information which has come to hand since our last issue, that the Boynton idea is beset with the same insuperable difficulties. Overhead is a central rail to act as a steadier of the single wheel cars beneath, the cars being thereby supported laterally by the agency of horizontal wheels bearing on each side of the guide rail. Again we are face to face with the fact that the inclination of the car, and therefore the deviation from the vertical of the line drawn through the upper and lower rails, must be a fixed quantity, closely approximating to what the velocity demands, and therefore that on every curved line there must be a fixed speed and a suitable inclination. Apart from these practical obstacles to success at high speeds, we confess we can see no mechanical difficulty in the Boynton idea; but we have yet to see a satisfactory statement from any single rail inventor or idealist as to this difficulty upon curves, and were we asked to name a good system of light railway for *moderate* speeds, such as might possibly pay its way in an agricultural district that would not support an ordinary line, we should be quite inclined to suggest the Boynton. Our contemporary, *Industries and Iron*, has an amusing account of an interview with an American, Mr. Overman, who is pushing the interests of the Boynton idea in this country, and it is very clear that he is fresh from the horrors of American track. It would be well were he to take a run to Grantham and back on our Great Northern Railway before he so entirely condemns the ordinary type of line. That the rigid attachment of two wheels to one axle is now universal, may result from the fact that no satisfactory "loose wheel" has yet been brought out; but this is not to say that it is impossible. All Mr. Overman's nonsense about centres of gravity resolves itself into nothing at all. That there is a small Boynton line at Coney Island, and another at Bellport, Long Island, proves nothing more than the mechanical possibility of the idea at moderate speeds. But we are not invited to a moderate speed. The suspension idea was for 100 miles an hour. The bicycle train is to go at 150 miles velocity, and it is as such that we must treat it. Probably the overhead guide wheels would make an intolerable rattle, but that is out of the question for the present. The idea is admirable for a straight piece of line, or for such easy curves as would be met by so small an inclination from the vertical as would not be serious, and as an electrically worked railway, this seems to possess peculiarly suitable features. We do not, however, forget that in 1883 a railway on what were practically identical lines, was brought out by a Mr. Danchell, and a model track of 60 feet diameter was erected at Maidstone, and a description appeared in the Electrical Review of December 22nd, 1883. In the following year a model was exhibited at the Aquarium, when it was announced that a trial had been determined upon of a small affair for parcel conveyance, although previously Mr. Danchell had talked of 150 miles an hour. Looking at the Boynton scheme, and at this older idea of Danchell's, we are puzzled to know wherein they differ.

Even though mechanically suitable for moderate speeds, we are doubtful upon that of structural expense. The upper guide rail must be well supported at frequent intervals, and this implies a continuous structure of braced posts and overhead girders, which cannot be put up for nothing, and may, if thoroughly worked out, go a long way in moderation of any favourable opinion that the fitness of the idea as a means of conveyance would otherwise earn. So much, then, for the mere lack of novelty in the invention, the difficulty in its arrangement for high speeds, and the probable very heavy cost of construction of the superstructure. Now as to the speed. Overlooking for the moment the above objections, what are the prospects on speed account. The late Robert Sabine made some experiments upon the power necessary to propel a surface of one foot square against the air at speeds up to 150 miles per hour, specially with a view to the possibilities of electric traction. He assumed that 10 lbs. per ton would cover the train resistance on a level. Above a certain speed the air resistance would be the chief resistance.

A vertical flat surface experiences a resistance proportional to its area and to the square of its speed. At 10 miles per hour the air resistance is only ½ lb. per square foot, at 50 miles it is 12½ lbs., at 150 miles it is 112 lbs., and at 200 miles no less than 200 lbs. per foot.

The following is Sabine's table of horse-power per square foot:—

Miles per hour.	Feet per minute.	Horse-power per square foot.
10	880	0·01
15	1,320	0·04
20	1,760	0·09
25	2,200	0·18
50	4,400	1·50
75	6,600	5·00
100	8,800	11·80
150	13,200	39·60
200	17,600	94·00

From which he draws the conclusion that air resistance is very serious; though, of course, the sharpening of the ends would diminish this. Smeaton's rule for wind pressure is $P = \frac{V^2}{200}$; which would give 45 horse-power at 150 miles per hour. Certain experiments made at Liverpool would seem to show that $P = \frac{V^2}{100}$; P and V being, as in Smeaton's formula, the pressure per square foot and the velocity in miles per hour. It is claimed by some that at high velocities the resistance becomes practically constant; and if this be so, it may be due to the possible fact that the air immediately in front of the flat surface piles up against it in a conoidal form, and thereby gives the effect of a blunted bow form. This form extending

further forward with increase of velocity would become more perfect as a cleaving point, and, perhaps, reduce the resistance as much as the increase of speed would add to it.

We believe that experiments with, and deductions from, the behaviour of trains in actual service bear out the above supposition. Indeed, it is obvious that, the cross section of a railway vehicle being quite 70 square feet, would easily absorb 500 horse-power at such high speeds as are often obtained, while the claimed rate of over 100 miles per hour (in America), with cars of probably 80 square feet of cross sectional area, would call for nearly 1,000 horse-power by Sabine's table, and for more than that amount by other tables, leaving some 300 horse-power for the train which was of such weight, that at only 12 lbs. per ton it would absorb 800 horse-power. While, therefore, there is ample reason to doubt the continued intensity of the air resistance at high speeds, there is equal reason to refuse acknowledgment of the easy possibility of attaining 150 miles velocity by electricity, or any other motive power. No practical car is likely to have less than 30 square feet of area; the Boynton car is shown with fully 70 feet area in its double deck, and if air resistance be only one-twentieth what Sabine gives for flat surfaces, it would consume 138 horse-power. Experiments are lacking to show the effect of sharpened figures, but there is enough known, and to be inferred, to make engineers very cautious in accepting claims for extravagant speeds. It is so particularly noticeable that the claimants always have so much to say upon the centre of gravity and the colossal blunders perpetrated in prevailing methods of construction, and yet cannot give a direct reply to what everyone is asking. It looks as though these schemes were simply made to sell. We observe that the Boynton locomotive of 16 tons weight is claimed to draw a train of 400 tons at 100 miles per hour, or at least to develop 400 tons traction. There must surely be an enormous error here, and a few lines later we find the train given as 125 tons.

Looked at as an ordinary light railway, the weak point is the expense of the superstructure. Should this not be so costly as we think it will be, there is nothing to bar the success of the idea so long as its backers drop their absurd claims for speed, and even this may not be beyond the limits of the possible if the railway be made straight. But it will not do for the ordinary features of the country. As it would seem that we are likely to have a crop of similar ideas for travelling at high speeds, we would suggest that those interested should institute a series of experiments on the air resistance against bodies of varying form. We confess to grave doubts as to the accuracy of any deductions from flat plate experiments when applied to bodies of any length. It is conceivable that at the rear of a moving flat surface there is a more or less perfect vacuum, and that a tapering stern would reduce the resistance exactly as does a tapering stern in a body moving in water.

The experience of any traveller is that there is a mass of compressed air in front of a fast running train, as shown by the sharp rattle of the window as it is forced against its frame, and, when the window is open, the physical sense of greater air pressure experienced, but just what the actual resistance amounts to is not known. Of late we have observed a tendency among American engineers to make light of the whole question of air resistance, but we do not know that they have anything tangible to go upon. Rather they would appear to be minimising the air effect in order to eliminate as far as possible those facts which tend to throw doubt upon the claimed velocity of 112 miles an hour upon one of their railroads, a velocity that it is exceedingly unlikely was actually attained. We would ask finally, why, if 150 miles an hour is to be attained on the Boynton line, was this speed not secured in America previous to the asking of support from the guileless and gullible Britisher? In Long Island there is truly nominally length enough wherein to start and stop a high flyer, but we have really not room enough to do it here, and in all seriousness we must state that, however mechanically pleasing the Boynton idea may be, if considered on sober lines, it is somewhat of an impertinence to put forward half digested schemes of this sort. We are so plainly given to understand that there will be curves, and yet nothing is said as to how passengers will fare when the patented inclination does not agree with the curve. Perhaps there will be patented passengers.

A NEW WOMAN AND A MODERN ALCHEMIST.

When the wife of Hector, in Homer's "Iliad" discourses with her husband about the battle in which he was going to engage, the hero desiring her to leave that matter in his care, bids her go to her maids and mind her spinning: by which the poet intimates that men and women ought to busy themselves in their proper spheres, and on such matters only as are suitable to their respective capacities. Now we are old-fashioned enough to think that this advice is worth tendering to-day—at least to those fussy quasi-hysterical ladies who vex their neighbours' souls with matters which they understand as little as their neighbours care about them. Such individuals are usually afflicted with a certain distemper which is mentioned neither by Galen nor Hippocrates, nor to be met with in any modern medicine book. Patients suffering from *Cacoëthes Scribendi* are sometimes curable by means of canterisation applied in the form of satire and lampoon; and it has occasionally been removed, like the biting of a tarantula by the sound of music, to wit, a "cat-call." Others derive little benefit from this drastic treatment, and their case must be regarded as hopeless. Of such is Mrs. Bloomfield Moore, a voluminous and persistent apologist for that fantastic nonsense, known as Keelyism, and who continues, in spite of the kindest and plainest criticism, to deluge transatlantic magazine literature with her adumbrations on the "sympathetic philosophy" of John Ernst Worrell Keely. Her disease runs apace, and even the aforesaid music administered in homœopathic doses on the principle of "like cures like" (for there is much ranting of music in Keelyism), seems unlikely to alleviate it, and the patient remains "about the same."

Mrs. Bloomfield Moore would probably tell you that she is a New Woman, and that the old-fashioned advice which we have tendered is not for her. Moreover, she would claim no special immunity from the freely expressed opinions of the common scientist. To which we would rejoin that whatever the date of her emancipation, we can but remember that she is a woman: deplorably quixotic no doubt, but a woman, and so many of those things which we have in our heart to say must remain there. A New Woman will possibly resent chivalrous treatment from the inferior sex: it is her way. She usually desires to pose as a mere human entity, but we cannot help that. We are sorry for Mrs. Bloomfield Moore. Though fussy and ultra-emotional, she appears to possess a rich full nature, and a faith born of the generous enthusiasm of her sex, which, if not strong enough to move mountains, is at least not of that order which a little girl once defined as "believing in things which you know to be untrue." She has helped Keely both morally and substantially. Your mere "cranks" do not often go so far as that. And though she believes herself to be the exponent of a "philosophy" which passeth the wit of man to comprehend, she is, so far as we are concerned *un quantité négligéable*. It is her master and his presumptions (we can hardly dignify them as teachings) with which we join issue.

In forming an estimate of John Ernst Worrell Keely, the Philadelphia experimentalist, we are materially assisted by an article in the first issue of the *New Science Review* on "Scientific Creation," by Julian Hawthorne, and especially by an appreciative *exposé* of his works and aims from the pen of Mrs. Bloomfield Moore in the same periodical, bearing the inflated title "A Newton of the mind." Here we read that more than 20 years ago Keely "discovered the unknown polar flow," whatever that may be, "and without giving any attention to research on the line of its origin, or of its operation, began to construct engines to apply the energy to mechanics." Here, at the outset, is a pretty pass. The man attempts to harness a something of which he admittedly knows neither the origin nor the *modus operandi*. Such fatuous effort could only court the failure it merited. It was blind empiricism of no higher a type than that which prevailed in the days of Pliny. What more can be said of the crass folly of a man who could thus go blundering along in the face of scientific history, reckoning as nought the methods of research by means of which every form of motor which we possess has been evolved. This futile endeavouring must have been abandoned, or Keely must have been supremely lucky, if we are to believe the statement that he now "has

command of a vibratory circuit for running machinery, both for terrestrial use and for aerial navigation," a "sympathetic affinity" having been effected between his machinery and "the polar flow, minus magnetism."

Then comes an alarming prophecy. "Through this system the dynamo will eventually become a thing of the past, and electric lighting will be conducted by a polar disc run by a vibratory circuit of sympathetic polar attraction drawn direct from space." As this consummation will prove a commercial disadvantage to many of us who now are humble caterers of electric light and power, it may be interesting and possibly reassuring to enquire into "the great truths of sympathetic physics" upon which it is all based. And we will try and dismiss from our minds the impression that hitherto no tangible results have been disclosed and that nothing has emanated from the Keely workshop save reports and assurances which have only afforded opportunities for the manipulation of Keely stock. [The Keely Motor Company's stock has been variously quoted, sometimes as high as 600 per cent. premium, oftener at *nil*.]

We have closely examined Mrs. Bloomfield Moore's article, which consists very largely of quotations from the writings of her prophet, given in illustration of the "great truths of sympathetic physics." We have had therefore an opportunity of looking at the man and his work through the spectacles of his most able and devoted supporter, we have wrestled with these illustrations and endured acute intellectual agony, but for the life of us we could not detect any coherency, much less truth. We would have been thankful for one syllable of sense amidst the whirl of words, if we could have found it. Mrs. Bloomfield Moore must stand upon an immeasurably higher intellectual plane than we, unfortunately, do, if she can grasp, much less state, anything of the prophet's meaning. A few hours with Keely, pure and unadulterated, would, we fear, leave us in a state of jabbering idiocy; as it was we felt an approximation to that condition of compound lunacy which some plain-spoken critic has already ascribed to the man. Keely's style has apparently been modelled according to the canons of alchemical mysticism. [Some passages curiously remind us of Basil Valentine's turgid thesis on "The Triumphal Chariot of Antimony."] To this has been grafted a sort of bastard metaphysics which simply bewilders the reader—an effect possibly contemplated, if not desired by the writer.

Keely in his attitude towards science in general is an anarchist. We are all wrong and he is all right. "Physicists have been working in the wrong direction to lead them to associate themselves with nature's sympathetic evolutions. It is not necessary to advance further into the unexplored region of these sympathetic flows than the ninths, to become convinced that the one I denominate the dominant is the leader towards which the remaining thirds of the triune combination (of triple sympathetic streams) co-ordinate. Whether it be cerebellic, gravital, or magnetic. When we reach the luminiferous track on the ninths, in the triple subdivision, we have proof that the infinite stream, from that unexplored region where all sympathetic streams emanate, is triune in character, having the dominant as the sympathetic leader, to which the remainder of the celestial thirds are subservient; the cerebellic being the dominant, and the triplets (gravital, electric, and magnetic), following in its train. The magnetic cannot lead the electric, nor the electric the gravital, nor the gravital the magnetic. All are subservient to the dominant. . . . . All sympathetic flows have this triune condition associated with them, the same as the molecular, atomic, and etheric aggregations of all forms of visible matter; the compound etheric or dominant being the leader and yet one of the constituents of the molecule itself." And so on till we find ourselves in an amazing muddle, feebly surmising that we have received a new and burlesque version of St. Athanasius's creed.

It may be complained that we are only giving isolated quotations, and that the context would make everything lucid. To which we reply that if all the extracts appearing in Mrs. Bloomfield Moore's article were reproduced here in their entirety we would defy anyone to understand their gist. We shall quote the whole of the description of the new Keely propeller but for the rest we must content ourselves with illustrations from Keelyism.

A glimmering of acoustic principles appears to pervade most of the gibberish which Keely calls "his philosophy." Now we plunge into a sorry travesty of musical terms with examples from the violin, and anon we learn that "one of the foundation stones of sympathetic or vibratory physics is that no differentiation can exist in the workings of the pure law of harmony." If this be correct it is argued that all so-called elements have a triple basis, for the system that represents harmony in one sense must represent it all, or everything would be brought into "chaotic confusion." That, it seems to us, is just "Where 'e are." The Keelyese harmony is full of discords and jars that would disgrace a travelling Chinese band. We speak figuratively, for that is the kind of expression that is best understanded of the Keelyites, at least it seems to be the only kind they indulge in.

Under the conditions of this Gospel according to Keely, hydrogen must "be composed of three elements and these three elements in turn must each have a triple formation, and so on indefinitely until merged into the infinite interluminous." We cannot permit Keely to claim credit for this rank plagiarism of the poet who sang :—

> Big fleas have little fleas upon their backs to bite 'em,
> And little fleas have lesser fleas and so *ad infinitum*.

We had proposed giving a number of words and phrases which occur pretty frequently in Keelyese, and adding a glossary of our own, but the subject is scarcely worthy of so much space as this would entail. Keely claims that he has succeeded in "hooking his machinery on to the machinery of nature," and the instrument with which he succeeds in effecting this is presumably the Keely propeller, the description of which we extract as it stands from Mrs. Bloomfield Moore's article; the italics, however, are our own.

"The space which the propeller of the air-ship occupies in Keely's laboratory *comes within a radius of six feet square*. A small space for so powerful a medium—*distributing over one thousand horse-power*—as tested by experiment. It consists of more than two thousand pieces, the principal parts of which are :—

1. *Positive Graduating Chladna:* Guiding by polar action toward the north and reversing by depolar action.

2. Sympathetic polar negative transmitter; for operating and controlling the action of the machinery in producing polar and depolar power; liberating the *latent sympathetic power* in twenty-seven sensitised discs.

3. Polar and depolar intermittent accumulator, carrying eight focalising discs for receiving and distributing the sympathetic polar negative flow. This device takes the energy sympathetically from the polar negative stream *on the same order that a dynamo registers electricity from the earth* to be distributed and redistributed: running the machine sympathetically.

4. Positive ring suspended on a small shaft with three points, the object of which is *to preserve the integrity of the neutral centre* of the machine.

5. Two resonating drums: one positive, one negative, which multiply the intensity of the sympathetic flow.

6. Twenty-seven depolar triple groupings, nine in each grouping, consisting of three *vitalised discs* with resonators. These reply sympathetically to polar and depolar action.

7. Large polar ring. This ring is associated with the central resonators by nine resonating polar discs placed at equal distances. This is the medium for distributing the polar flow.

8. Small negative ring, which is the governor of the propeller, associated with a polar bar that oscillates from the polar field to the depolar field, *somewhat on the order of a magnetic needle*, governing the action of the machine to any given number of revolutions. The sympathetic rotation that exists in the resonating centre of this ring holds the neutral centre in subservience to celestial radiation, whereby a certain order of sympathetic disturbances gives the sympathetic radiation the requisite power to draw it to itself, accomplishing what is called *atmospheric suspension* on the same principle as that of sympathetic suspension."

Such is the only specification of the Keely propeller which we have to date. Keely says, however, in explanation of his engine :—"In the conception of any machine heretofore constructed, the medium for inducing a neutral centre has never been found. If it had, the difficulties of perpetual motion seekers would have ended, and this problem would have become an established and operating fact. It would only

require an introductory impulse of a few pounds, on such a device, to cause it to run for centuries. In the conception of my vibratory machine I did not seek to attain perpetual motion; *but a circuit is formed that actually has a neutral centre*, which is in a condition to be vivified by the ether, and which, under operation by said substance, is really a machine that is virtually independent of the mass (or globe), and it is the wonderful velocity of the vibratory circuit which makes it so." From this, the clearest sentence we have yet found in Keelyese, we gather that without seeking the *perpetuum mobile* this wonderful man has practically attained the conditions which govern it and make it possible!

And now let us endeavour to appreciate John Ernst Worrell Keely, and to place him in his appropriate category. That he has stuck to his last for upwards of twenty years no one can deny, and in spite of the immense sum of money that was raised for him he is *said* to be living in squalid circumstances. His foibles are claimed to be such as geniuses are wont to manifest. He believes in himself; whether the belief be insane or otherwise he possesses it. There are those who regard this as evidence of sincerity, but it only reminds others of poor old George III., who was convinced that he was the conqueror at Waterloo. The failure of his attempts to explain himself have been regarded as his misfortune. Enthusiastic followers, whose numbers are now, however, painfully few, have even regarded his incoherency as a virtue, and they contend that such "indiscretions" as he has been guilty of are not those of a sharper. They remind us that "there are more things in heaven and earth than are dreamed of in our philosophy." All this may be, but the man of the world, to say nothing of the man of science, can only judge by results. He cannot be expected to swallow the outrageous incongruities of the man with a light heart and a clear conscience. For our own part we confess that we cannot stomach them.

In common report Keely is held to be little better than a charlatan and a humbug. He has been affectionately designated a Cagliostro, a compound lunatic, an impostor, a plagiarist in cerebral dynamics, &c., &c.; and his motor is uniformly referred to with a smile of scepticism. This incredulity must have a cause, and it is not far to seek. For twenty years or more he has been before the public. From time to time during that period he has allowed rumours to transpire of great things which he was on the point of accomplishing and upon the strength of these reports and assurances money has been subscribed and a company organised, with disastrous results. And yet, from first to last, Keely has always disappointed popular expectation. He has pursued a Fabian policy and no practical machine, no generally comprehensible result has ever yet come out of his workshop. *A barbe de fou, on apprend à raser.* Keely's experiments have been made at the expense of others, but he has not verified the old French proverb yet. He is still learning "to shave." At this day, in spite of the assurances of worthy Mrs. Bloomfield Moore, so far as the world knows, he is as far from the solution of the enigma as at the first moment he turned his attention to it. Nor is this all; in response to more or less pressure from without Keely has occasionally endeavoured to give an account of himself with the result of darkening counsel to such a degree that even his nearest allies are powerless to enlighten it. The terms of the language in which he purports to express himself are unintelligible: his deliverances read like gibberish, and it is not surprising that most people reach the conclusion that the man is only seeking to disguise beneath an inky discharge of incomprehensibilities the dismal fact of his own ignorance and emptiness. His method is *obscurum per obscurius.* Whilst proposing to explain he involves himself in a cloud of meaningless words and renders dark what in all conscience is sufficiently dark without his explanations. Every "explanation" which he vouchsafes is but an *ignis fatuus*, which, while it affects to enlighten, tends only to confound and mislead. It is impossible to translate Keelyese into everyday scientific phraseology; he commits a deliberate abuse of terms and so prostitutes the language that the brain reels when striving to comprehend his fantastic vapourings. To think that clever Yankees subscribed their dollars in thousands to exploit this man and his ideas! *On prend le peuple par les oreilles, comme on fait un pot par les anses.* But we thought the Americans prided themselves on their incredulity. "Jabez" should have operated in the States, for he, like Keely, is saturated with what he is pleased to call "religion."

To sum up briefly, there appear to be three courses open to us (*a*) to believe that Keely is a near relation of the proverbial gasmeter; (*b*) to regard him as *non compos mentis*, or in plain Scotch, as having a bee in his bonnet; or (*c*) to look upon him as a man of some ingenuity, born about five hundred years too late. We incline on the whole to this last view. We believe him to be what the botanist calls a "sport," the zoologist "a reversion to an earlier type," such as pansy growers, pigeon breeders, and more especially the working biologist, occasionally meet with. In the highly specialised development of the race which is going on to-day it would be odd if humans, like the other animals and the plants, did not sometimes "strike back" and reproduce very closely the characteristics, mental and otherwise, of long remote generations. John Ernst Worrell Keely is an alchemical mysticist of the time, say, of Raymond Lully. Indeed he possesses many features which bring him into line with this almost forgotten worthy, as will be evident when we remember that Lully had for his patron the Lady Eleanor of Castello; that he professed deep religious convictions and missionised the Mussulmans; that he wrote a good deal of pseudo-scientific jargon; that his opinions even in those days were held of no account; that he was regarded as somewhat of an impostor and died after being stoned at Tunis. Of the alchemical philosophy it was truly said: *Ars est sine arte, cujus principium est mentiri, medium laborare, et finis mendicare.* Need more be said of the "sympathetic philosophy"?

L'envoi.—Life being too short, and withal, too interesting, to leave time for attempting to grapple with all the incomprehensibles which we encounter, it conduces to a certain orderliness and comfort of mind if we are able "to place" them. Keelyism therefore may be suitably relegated to that limbo which happily has already received the Crystal Spheres of the Planets, the Four Elements, Caloric, Phlogiston, the Electric Fluid and the Odic or Psychic force; and is destined to absorb many another product of the disordered and misguided imaginations of mankind.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.

The following is the preliminary programme of the American Electro-Therapeutic Association, which will hold its fourth annual meeting at the New Academy of Medicine, New York, September 25th, 26th, and 27th:—

President's Address.—Dr. W. J. Herdman, Ann Arbor, Mich., Professor of Diseases of the Mind and Nervous System and Electro-Therapeutist in the University of Michigan.

Report of Committees on Scientific Questions.

On Standard Coils.—Dr. Wm. Jas. Morton, New York.
On Standard Meters.—Dr. Margaret A. Cleaves, New York.
On Standard Electrostatic or Influence Machines.—Dr. Wm. Jas. Morton, New York.
On Constant Current Generators and Controllers.—Dr. W. J. Herdman, Ann Arbor, Mich.
On Standard Electrodes.—Dr. A. Lapthorn Smith, Montreal.
Stand and Electrode for Static Electricity: Exhibit of same.—Dr. Lucy Hall-Brown, Brooklyn, N.Y.
On Electric Light as a Therapeutic and Diagnostic Agent.—Dr. Margaret A. Cleaves, New York.

The Constant Current.

Physics: Current Distribution.—Mr. W. J. Jenks, M.I.E.E., New York.
Physiological Effects.—Prof. H. E. Dolbear, President Tufts College, Boston, Mass.
Therapeutic Uses: General.—Dr. A. D. Rockwell, New York.
Gynaecology: The Galvanic Current in Catarrhal Affections of the Uterus.—Dr. G. Betton Massey, Philadelphia.
Suites eloignées du Traitement Electrique Conservateur Gynaecologie Grossesses Consecutives.—Dr. Georges Apostoli, Paris.
Metallic Electrolysis.—M. le Docteur Georges Gautier, Paris; Dr. W. J. Morton, New York; Dr. Margaret A. Cleaves, New York; Dr. A. H. Goelet, New York.
Treatment of Urethral Stricture, Report to date.—Dr. Robt. Newman, New York.
Diseases of the Eye, Electro-Therapeutics of.—Dr. L. A. W. Alleman, Brooklyn, N. Y.

Notes on Goitre and Improvements in Apparatus for Treatment of Same.—Dr. Chas. H. Dickson, Toronto.
Diseases of the Throat.—Dr. D. S. Campbell, Detroit, Michigan.
The Action of Electricity on the Sympathetic.—Dr. A D. Rockwell, New York.
Diseases of the Nervous System.—The Treatment of Neuritis by the Galvanic and Faradic Currents.—Dr. Landon Carter Gray, New York.
Electric Sanitation.—Prof. John W. Langley, Ph.D., Case School of Science, Cleveland, Ohio.
Physics of the Electric Light in Relation to Organised Matter.—Prof. John O. Reed, Ph.M., Assistant Professor of Physics, University of Michigan.
Hydro-Electric Methods, Physics and Appliances.—Mr. Newman Lawrance, M.I.E.E., London.
Special Hydro-Electric Applications.—Dr. Margaret A. Cleaves, New York.
The Hydro-Electric Therapeutics of the Constant Current.—Dr. W. S. Hedley, Brighton, England.

Induction Currents.

Interrupted Currents: Physics.
Physiological Effects.—Dr. W. J. Engelmann, St. Louis, Mo.
Therapeutic Uses: General.
General Faradisation—Dr. A. D. Rockwell, New York.
Gynaecological.—Dr. A. H. Goelet, New York; Dr. H. E. Hayd, New York; Dr. A. Lapthorn Smith, Montreal.

Sinusoidal Current.

Physics.—Mr. A. E. Kennelly, F.R.A.S., Philadelphia.
Physiological Effects.—Dr. W. J. Herdman, Ann Arbor, Mich.; Dr. J. H. Kellogg, Battle Creek, Mich.
Therapeutic Uses.—Dr. Margaret A. Cleaves, New York; Dr. William Jas. Morton, New York; Dr. J. H. Kellogg, Battle Creek, Mich.; Dr. Holford Walker, Toronto; Dr. A. H. Goelet, New York.
Le Courants Alternatifs; leur transformation; leur mesure et leurs applications therapeutiques.—M. le Docteurs Gautier et Larat, Paris.
On the Sinusoidal Current Method of Regulation, the E.M.F. and Resultant Current.—Dr. Lucy Hall-Brown, Brooklyn, N.Y.

Static and Static Induced.

Physics.—Prof. Edwin Houston, Ph.D., Philadelphia.
Physiological Effects.—
Therapeutic Uses: General Therapeutic Uses.—Dr. William Jas. Morton, New York.
The Treatment of Chorea.—Dr. D. R. Brower, Chicago.
Static Induced.—Dr. Margaret A. Cleaves, New York.
High Frequency Currents derived from Static Machines as per Method d'Arsonval, Dr. J. H. Kellogg, Battle Creek, Mich.

In Memoriam.

Dr. William F. Hutchinson, Providence, R.I.; Dr. Robert Newman, New York; Dr. John Chambers, Indianapolis, Ind; Dr. Plymon S. Hayes, Chicago; Dr. W. J. Herdman, Ann Arbor, Mich.

LEGAL.

The Cassel Gold Extracting Company, Limited v. The Cyanide Gold Recovery Company, Limited, and Others.

(*Continued from page* 137.)

Fifth Day.—Friday, July 27th.

Mr. James Mactear was further cross-examined by Mr. Moulton, as to one of the best enunciations of the property that cyanide of potassium would, in the cold, dissolve metallic gold at a practical rate, and produced the "Circle of the Sciences," which had been in his possession since before 1868. Witness referred to several passages, amongst them being paragraph 229, page 237, Vol. 1. That, he thought, fairly represented the state of common knowledge upon this point.

Re-examined by Mr. Neville, Witness said that "Elements of Chemistry," by Miller, was a well-known and an old book. At page 744, it said, "Cyanide of potassium is a powerful reducing agent. . . . . Silver and gold are also dissolved by the solution of potassic acid if air be allowed free access, and double cyanides of potassium with those metals are formed." Gold mining in England was not an industry. There were practically no gold mines, except Mr. Pritchard Morgan's.

Mr. Robert Henry Harland was then cross-examined by Mr. Moulton as to the experiments with and without an electric current. He said that he was not an electrician, and after the cross-examination had proceeded some time,

Mr. Justice Romer said he could not see why they should not have taken the test in the ordinary way, that was to say, take the Pielsticker machine, work it for 24 hours with the current, and then for 24 hours without, and then see how much more deposited gold you got in the one case than in the other. His remark applied to both sides. Was there any difficulty he did not foresee?

Mr. Moulton: None.

Mr. Justice Romer said he was bound to say he did not see why they should not have an experiment further, if both parties agreed that it was important. He could not say whether it was essential to know this to decide the case, still it might be.

Mr. Moulton thought it would be far better that it should be tried.

Mr. Neville thought it was a very subsidiary point.

Mr. Justice Romer agreed that it was somewhat subsidiary, but he could not say that it was a point to be wholly disregarded.

Mr. Neville said the defendants felt that the decision of the case would inevitably be delayed if it was to be a practical experiment for practical working.

Mr. Justice Romer said that if either side was going to rely on these experiments, he must say the present state of the evidence was most unsatisfactory. He should like to have experiments tried by some person not belonging to either side, who was competent to judge.

Mr. Bousfield said: You could have a double check, by trying the ore and seeing which had got least gold in it.

Mr. Justice Romer: Yes, and the result would be absolutely free from doubt. If either side is going to rely on the fact of whether electricity does in this case, or does not affect the result, then I should like an independent experiment to be made.

Mr. Neville suggested that the case should be heard out, and then, if necessary, the experiments should be made.

Mr. Justice Romer: Are you prepared to abandon the point that the electricity has this effect?

Mr. Neville could not do that without consultation with Sir Edward Clarke.

It was then arranged that they should finish the case, leaving the question of the experiments in abeyance.

Cross-examination continued: The result of his experiments as to selective action was to show that there was no line that you could draw and say the solution had a selective action for the gold as against the base metal. If you used a stronger solution in every case you got up more metal and more gold than with a dilute solution.

Prof. J. Attfield, F.R.S., &c., gave evidence to the same effect as the other chemical experts for the defendants.

Mr. Justice Romer: Do you think that at the beginning of 1887 any invention was required to discover that a solution of cyanide of potassium could be practically applied to dissolve gold and silver in crushed ore?—I do not.

Cross-examined by Sir R. Webster: Simpson and Rae distinctly said that you might attack the gold in ore. Witness then referred to a handbook on chemistry, by Leopold Gonelin, which at page 15 said: "Even a plate of gold will dissolve in a solution of cyanide of potassium, especially if exposed to the joint action of a solution of cyanide of potassium and to the air." This book was published in 1853. Asked if he alleged that the chemical conditions with regard to the access of oxygen would be the same if you were to put tons of ore in cyanide of potassium as in the experiment, witness said he did.

Mr. Claude Vautin, recalled, said that a process for extracting gold from ores which took 12 hours, would not be a prohibitive time.

Mr. J. S. MacArthur, recalled, said his process ranged, when stirring was used, to from 2 to 12 hours.

Cross-examined by Mr. Bowick: In the Transvaal they generally did not stir, and then the solution was in contact with the ore for about 18 hours.

Mr. Neville said he had consulted with Sir Edward Clarke, and they were sufficiently satisfied with their case on the broad lines, and desired not to have the experiments about the effect of electricity.

Mr. Justice Romer: That is, you will try the case on the footing that you have not used experiments.

Mr. Neville: I think it will come to that.

Mr. Thomas Gilbert Bowick presented himself for examination, and having been sworn, said that he was one of the defendants, and chairman of the defendant syndicate. He quite agreed with Mr. Janin when he said that cyanide of potassium was known to every intelligent mining man as a solvent of gold from ore for a great many years past.

Mr. Justice Romer: Knowledge in the United States is not knowledge here.

Mr. Bowick said the fact of people coming backwards and forwards into this country would naturally bring the knowledge over here. He had seen millions of tons of ore and tailings in the States that it was absolutely impossible to handle by means of cyanide of potassium, because of the baser metals present. The statement by Mr. McCulloch that 500,000 ounces of gold had been recovered by the plaintiffs' process in the Transvaal was most misleading. The plaintiffs' specification in the Transvaal was not the same as here. They had added to it a metallurgical filter. The gold they had recovered was by the assistance of the zinc filter, and that was the only novelty in their process. Mining men were not now paying royalties to the plaintiffs in the Transvaal or elsewhere, but were refusing to pay them on the ground that cyanide of potassium was well known previously, and as long as they could precipitate by any other known method besides zinc, it was not necessary for them to pay royalty.

Sir R. Webster said that a syndicate had been got up in the Transvaal to fight the patent there. That was why royalties were not being paid.

Mr. Bowick said that mining companies out there, that were not members of this syndicate, were working other processes, and absolutely declining to pay a royalty on this patent. The MacArthur American patent was not the same as the British patent, the use of cyanide of potassium having been disclaimed. Also there was no mention made of "compound containing cyanogen;" it was merely cyanogen *per se*. Witness then referred to the specifications.

There was no cross-examination.

This was the defendants' case, Mr. Goodeve relying on the evidence called for the company.

Mr. Neville then summed up the case for the defendants. He said that his task was very much shortened by the course which the action had now taken, because they might have gone on fighting about this question of electricity almost until doomsday. There was one very important point which seemed to him to be conclusive—that the plaintiffs, in their specification, had claimed the process of obtaining

gold and silver from ores and other compounds, "consisting in dissolving it by treating the powdered ore or compound, with a solution containing cyanogen or cyanide or cyanogen-yielding substances substantially as hereinbefore described." That "substantially as the hereinbefore described" could not limit the claim to the solution which might be used, which was any solution containing cyanogen, &c. If that was so, that obviously applied to Simpson, that obviously applied to Rae, who both of them used a cyanogen containing solution for the purpose of extracting gold from ore. There was an end of the case.

Sir R. WEBSTER: If that were the only point, I should apply at once under the Act to be allowed to disclaim.

Mr. NEVILLE said it seemed to him that would be rather a late application. He was not going to leave it in that bald way. There were one or two considerations which disposed of the argument that this was a meritorious invention, which had revolutionised the mining industry, and resulted in the saving of an enormous mass of gold or ore. This process, so far as it had been successful in South Africa, had depended not upon the very easily worked method of dissolving the gold from ore, but had depended upon finding a workable and suitable method of getting the gold out of the solution when you once got it there. The evidence was, that not one ton was ever commercially tried until they had arrived at a suitable process for extracting the gold.

Sir R. WEBSTER thought this was not fair.

Mr. JUSTICE ROMER said the point of it was that the plaintiffs said that Rae and Simpson were not used, and Mr. Neville was pointing out why.

Mr. NEVILLE then called attention to the fact that the plaintiffs in their complete specification made a point about the solutions being very dilute, and to their saying nothing about that in the provisional. The use of cyanide of potassium alone was put forward as the distinction of this patent process. Could the plaintiffs, under any conceivable circumstances, have a patent for that? Of course, if it was not the use of a solution of cyanide alone, then in any conceivable view Simpson's patent was fatal to them, because Simpson's patent, according to their own showing, was for the use of cyanide of potassium for this very purpose, and in this very manner subject to the slight admixture of another chemical which they said did not add to the effectiveness of the solution; in fact, possibly it was a disadvantage; but what they said with regard to this was, that in its applicability to some acid ores, Simpson's mixture would be preferable to the cyanide of potassium alone, but they thought that with regard to the other ores, it would be detrimental to the action of the cyanide of potassium. All the plaintiffs' witnesses admitted that Simpson's patent would be perfectly effective for the purposes of getting gold into solution. That being so, how was it conceivable that the plaintiffs should come and say, "I claim a patent for using cyanide of potassium alone, there being in existence a process the bulk and mass of which is the treating of the ore by the cyanide of potassium, but with a slight admixture, which may or may not be useless, or may or may not be slightly detrimental?" Whichever way you looked at it was effective, and then the patentees came and said, "Although all the world may use 16 of cyanide of potassium to one of carbonate of ammonia, we alone are entitled to use 16 of cyanide of potassium and no ammonia at all."

Mr. JUSTICE ROMER: You have only to add your carbonate of ammonia, and then you are free.

Mr. NEVILLE: Yes, one-sixth of an ounce, so long as it is not cyanide of potassium alone. The amusing part of it was that in commercial cyanide of potassium you had this very article of ammonia which was put in by Simpson. He submitted that it was impossible that after the date of the publication of Simpson's patent anybody should be entitled to come and say, "I will prevent all the world from using cyanide of potassium for the purposes for which they knew it to be applicable to and useful for, unless they put some carbonate of ammonia in." With regard to Rae, it was suggested that he thought he was going to get an electrical operation which the witnesses said he did not get; but he submitted that Rae disclosed in the plainest possible way the knowledge that cyanide of potassium was a solvent which could be used for the purpose of dissolving gold found in ores. The answer to his friend's argument was that it never occurred to Rae and Simpson to state what had been found in chemical books since 1805; that they had discovered that cyanide of potassium was a solvent of gold, or a solvent of gold in ore. They started on the assumption that that was generally understood. He submitted that Rae knew that he could not claim the use of cyanide of potassium for a perfectly well-known purpose, and tried to claim for the conjunction of that with electricity. On the evidence they had it, with regard to Rae, that in fact he did get the result aimed at by the plaintiff, and in precisely the same method, because the witnesses said that the electric current did not avail him as he thought; so that the plaintiffs' patent consisted of abandoning the single part of the operation of Rae, which the plaintiff alleges he has discovered to be unimportant or unnecessary. The learned counsel then proceeded to call attention to what the plaintiff claimed as his secret being found in popular books, and to say that patents in connection with the extraction of gold from ore were taken out in America rather than here, because here we had no gold ores to make them necessary. The utility of the plaintiffs' patent depended upon the ore it was applied to, and the evidence was that there were ores in America and Australia to which it could not be successfully applied, because of the baser metals in combination with the gold. In view of that fact, could the plaintiffs have a patent for the use of cyanide of potassium generally? Really it was, if he might say so without disrespect to the other side, an absurdity to suppose that the plaintiffs could keep the world from using a solution of cyanide of potassium for the extraction of gold from ores, and still more absurd, having regard to the fact that before the claim to do so was made this very substance had been used for this very purpose in the way it had been by Simpson and Rae.

Mr. GOODEVE addressed the Court on the same lines for the defendant Pielsticker.

Mr. BOWICK said a few words.

Sir R. WEBSTER addressed the Court, in reply, on behalf of the plaintiffs, first dealing with the law applicable to the case. He could not help thinking that one defect in the arguments of his learned friends was, that they had not appreciated that however well known a scientific fact might be, it would not invalidate a claim for a new process of applying that scientific or chemical principle with knowledge. In spite of the answers which had been given to his Lordship as to its not requiring invention to discover that a solution of cyanide of potassium could be practically applied to dissolve gold in ore, he was going to contend that this patent was a valid patent, and could be supported; that it was not true that for purposes of public and useful knowledge it was known that cold cyanide of potassium, whatever strength of solution, would, as a practical process, dissolve gold out of ore. His submission was, that there was here a new result and a new process, and that both new result and new process required experiment, research, and invention. The learned counsel then cited a number of cases in support of his legal propositions, and submitted (also on authority) that the existence of the chemical principle by which the success of the invention had been carried out was not in any way an objection to the patent. He respectfully submitted that it was the law that the useful application of a known laboratory fact, or the useful application of a known chemical fact for the first time for a commercial purpose successfully, was good subject matter, and that it would not be invalidated by any previous publication, unless that previous publication told the people how to do it in such a way that from the previous publication alone the workman, or the scientific man anxious to understand, would have been led to follow that particular process which was the subject of the invention.

Adjourned until the following Monday.

SIXTH DAY.—Monday, July 30th.

Sir R. WEBSTER, resuming his reply on the whole case, said that he had dealt with the sort of publication necessary to anticipate the patent, and he now proposed to examine the existing state of knowledge from the points of view of what the general knowledge showed, and what was disclosed by specific exposition. The publications which the defendants relied upon as best from the point of view of anticipation were four in number. Mr. Vautin said Dixon was the best, Mr. Riley said Dixon and Faraday, Mr. Mactear said Faraday and the "Circle of the Sciences," and Prof. Attfield said Gonelin told people everything he thought they need know. His (Sir R. Webster's) respectful submission was, that so far from these publications, or any of them, having told persons that they could extract gold from ore or gold from anything by cyanide of potassium, they would have led people away from that knowledge. One broad observation that might be made was, that nobody could predict, simply because a chemical was a solvent of gold, that it would be useful as a solvent of gold in ore. The most well-known solvent of gold was *aqua regia*, and it was admitted by everybody that that was absolutely useless for the purpose of dissolving gold out of ores. Next, *aqua regia* was only a solvent because two acids (nitric and hydrochloric) were mixed together, neither of them having any action on the gold when they were not mixed together. With regard to the knowledge which the defendants' witnesses said was disclosed in chemical literature, the learned counsel said that not a living being of all these chemists had given the Court an instance of the practical application of this knowledge. Was this any knowledge at all that gold could be extracted from ore? To say that people were to pick up these scraps and say that they had taught the world that which made Mr. MacArthur's patent of no value, was to exclude the reasoning which ought always to be brought to bear upon the simplest cases, and *à fortiori* upon a complicated case like this. It was common ground that there was no prior user in this case.

Mr. JUSTICE ROMER: In England.

Sir R. WEBSTER said he should show that there was evidence of no user of Simpson or Rae anywhere in a sense that would invalidate the patent. The learned counsel then drew attention to passages of evidence with a view of supporting this proposition, and went on to say that he did not know of any case where it could less be said that a patentee was availing himself of previously known scientific facts to bolster up a claim which, when investigated, could not be supported. The knowledge about cyanide of potassium did not lead Prof. Roberts Austin or Mr. MacArthur to the knowledge that cyanide of potassium was a solvent of gold in its ore. Why should it not have done so as much as the people who came afterwards and said that their minds would have been led to it.

Mr. NEVILLE called attention to the fact that Mr. MacArthur said that he did not know of Simpson's or Rae's patent.

Sir R. WEBSTER said he was dealing with general knowledge, and specifications did not come under that head. Even if they did, these gentlemen did not rely upon the specifications. If this was merely a question of solvency, why had *aqua regia* not been taken, that being known to be infinitely more a solvent than cyanide of potassium? It had not been challenged that no chemist could predicate from the mere fact that cyanide of potassium would have a solvent effect upon gold in a given condition, that it would act upon gold in ores. Having referred to the evidence upon this point, the learned counsel came to what he termed the two most important points, namely, the alleged anticipations of Rae and Simpson. The defendants, he said, came into Court to win this case upon Rae's specification, they came to prove that they were electrically depositing the gold out of the ordinary solution, and not using the chemical action. He did not hesitate to say that his Lordship had seldom heard so complete an abandonment of a case the defendants came into Court to prove. How did the matter stand? In the tank A there was an anode and

a cathode used for the extracting of gold out of the solution in a well-known manner. The plaintiffs called evidence to prove that when the electric current was passing as the defendants used it, it had no effect on the dissolving action of the solvent as distinguished from the depositing action. The plaintiffs tested that in two ways. They said, first, that there was no deposit on the cathode, G; and if it had been true that the electricity had a solvent action, the deposit would have been there. At that juncture it was pointed out by the Court that the state of the evidence was so unsatisfactory that further experiment ought to be made. The plaintiffs had called Lord Kelvin, who might have been right or wrong, but he prescribed his own apparatus, and the experiment carried out by him did prove that there was less gold when the current was passing than when it was not. The defendants took the apparatus away, and they gave evidence that Lord Kelvin's experiment was untrustworthy, because the solution could pass through the second carbon division. Thereupon the plaintiffs in open Court offered that these experiments should be renewed. What happened? The defendants abandoned the electricity distinction; they were obliged to admit that they could not rely upon any distinction due to the fact that they had super-added electricity to what Mr. MacArthur had patented. With regard to Rae, he asked the Court to remember that the evidence was that Rae had abandoned the cyanide of potassium and worked by electricity alone. What was necessary in order that Rae could be held to be an anticipation of the plaintiffs' patent? He said without hesitation that sufficient directions must be found to tell people to abandon the use of electricity and to rely upon the dissolving action of the cyanide of potassium.

Mr. Justice Romer said that what would be said against the plaintiffs was this: that the general knowledge was that cyanide of potassium would dissolve gold under certain circumstances, and though there possibly might be a doubt whether you could dissolve gold in crushed ore, here was Rae saying, "You certainly do, and the use of the electric current will facilitate it."

Sir R. Webster: I say the electricity is to make the solution.

Mr. Justice Romer did not take that view, having regard to the language of the specification, and said that the defendants said that if any person had any doubt whether cyanide of potassium would dissolve the gold in the crushed ore, after reading Rae he could not have had a doubt about it.

Sir R. Webster said that the strongest thing in his favour was that Rae had told people that they could have a perfect solution by the aid of electricity; Rae had never told people that they could get a perfect solution by the action of the chemical. What Rae said was that if you desired to get the maximum amount of gold you must have electricity. He (Sir R. Webster) denied that the defendants were entitled to eke that out by saying that it was previously known that cyanide of potassium had a solvent action on gold in ore. Rae had told people that cyanide of potassium had a certain solvent action on gold in ore, but that if it was desired to make it a practical solution you must have electricity to aid it. He knew of no case in which, in order to invalidate a patent, the defendant had been allowed to rely upon that which was contrary to the directions of the alleged anticipating patent.

Mr. Justice Romer said that this was not put against the plaintiffs as anticipation directly, but on the question of anticipation generally. It was said by the defendants that if the cyanide of potassium was found to dissolve gold, presumably it would dissolve gold in ore, but if there were any doubt that it could be applied usefully, Rae said it could be applied usefully, though it was the better to have electricity.

Sir R. Webster denied that Rae said that, and submitted that this kind of anticipation was sufficient to invalidate the patent. If it were, he would like to know what became of the doctrine about "new and useful process."

Mr. Justice Romer said that there was not much use for this process in England.

Sir R. Webster could not accept as accurate the evidence given on this point. Why had not the defendants worked boldly according to Rae? He knew of no case where it had been laid down that you could pick out the gem of an alleged anticipating specification, in order to invalidate a subsequent useful patent. It was extraordinary that Simpson should be suggested as an anticipation, because, according to Simpson, you were to take cyanide of potassium with a substance that destroyed it. The defendants here were trying to say that because the plaintiffs had told them that one substance would do, therefore they could leave one out. With regard to the suggestion that persons had paid £117,000 for a step which was merely the omission of a chemical from Simpson, he asked the attention of the Court to the greatness of the step taken by the plaintiffs' invention. It was not until the reply that any suggestion was made that it was not a great step. Mr. Neville had attempted to say that it was the improved method of zinc extraction, and not the getting of the solution which had made the patent valuable. That was not warranted by the evidence or by the specification. The difficulty was to get the gold into solution; there was no difficulty in getting it out. Mr. MacArthur had added an improved filter, but nobody who had heard this case would suppose that the improved zinc filter had anything to do with getting the gold out of the ore. The learned counsel then combatted the point of the defendants that the plaintiffs' patent was one for everything which happened to have cyanide of potassium in it which would dissolve gold, by submitting that the fair meaning of the plaintiffs' specification was the making of a compound of matters which would give a mixture in terms of cyanogen. Attention was then called to the fact that the use of zinc for extracting the gold from the solution was well known at the date of the patent, though Mr. MacArthur's subsequent method was an improvement. In conclusion, the learned counsel said that this case was to be decided by the evidence, and he submitted that this most useful invention, which had been patented by the defendants, because it was a useful invention, was the result of experiment, research, and the bringing to bear of great skill and knowledge; that it had not been generally or specifically anticipated, and that the defendants ought to be restrained from taking that which had been proved to be a new and useful invention.

Mr. Justice Romer reserved his judgment.

Woodhouse & Rawson United, Limited.

Public Inquiry before Mr. Registrar Hood.

(*Continued from page* 138.)

The enquiry into the failure of this company was resumed on Monday last before Mr. Registrar Hood at the London Bankruptcy Court.

Mr. F. L. RAWSON was again called and further examined by Mr. Pilling. He said that the consideration received by the Phœnix Trust Company for underwriting the £20,000 worth of Elmore shares was that they were to receive three-fourths of the profits. He (witness) held a fourth of the preference shares of the Phœnix Trust, and would therefore have been entitled to a fourth of the profit so made. As a matter of fact, all he received in respect of it was about £200. A large amount of work was done by the Phœnix Trust in connection with underwriting the shares. It was true that a large amount was received in cash by the Phœnix Trust for the formation of the French Elmore Company, but the whole of the amount was at once reinvested in shares of the same company. The shares at that time were expected to go to a large premium. He (witness) himself bought 500 shares in the company at a premium of 100 per cent. In the case of the Austrian Elmore Company, the consideration was received almost entirely in shares. The United Company also received £20,000 worth of debentures as commission upon the sale of the German patents. By agreement with the Phœnix Trust, three-fourths of this amount went to them. He could not say who personally prepared the estimate showing a profit of £75,000 during the year ending June 30th, 1889. The whole of the figures were gone into in detail at the time, but he was not aware that there were any data now existing showing how that amount of £75,000 was arrived at.

Mr. Pilling: Who was responsible for that estimate?

The Witness said that, in his opinion, the whole of the directors of the Limited Company would be responsible for the statement. Mr. Pixley was requested by the directors of the new company to look into the matter and report to them, and after a full examination of the books he reported that the estimate was an accurate one. There was no stock-taking at the time the estimate was made. Mr. Pixley saw the accountants and other officials, and also the secretary of the Elmore Company, before sending in his report. To the best of his (witness's) recollection the estimate of £75,000 was arrived at by the directors of the new company upon the figures which witness placed before them. Mr. Pixley was asked by the directors to prepare a balance-sheet for the purpose of the estimate, but he stated that this could not be done in the time at his disposal. All the shares included in the estimate were taken at par, although some of them were at the time at a premium. According to balance-sheet for June, 1889, the total assets of the Limited Company amounted to £362,000, including the patents and goodwill, against liabilities £49,000.

Mr. Pilling: According to that, there would be £313,000 to divide among the shareholders?

The Witness said that from that amount had to be deducted all the expenses connected with the sale to the new company, which were very large. The £28,000 appearing as a loan to him was advanced by the company at the time when he bought the 5,000 preference shares at a premium of 5s. He was to leave these shares with the company until the money was repaid, and they still stood in his name, with the exception of a small number which he had given as a present to Mr. Stepney Rawson, with the consent of the board, in consideration of that gentleman's special services. He (witness) had throughout steadily increased his holding in the company. The directors also held a charge upon his interest in the founders' shares of the Limited Company. Speaking generally, he received no cash from the directors except when it was required for some share transaction for the benefit of the company. In December, 1892, by agreement with the company, he handed over £21,000 worth of debenture stock in the Limited Company in reduction of his debt. He did not personally receive anything in respect of the promotion of the Phœnix Trust, and the whole profit went to the United Company. The matter only came before the shareholders in the form of "gross profit," but they were told that profits had been made in connection with companies. At the time when he (witness) made up his account with the Phœnix Trust, he estimated that, taking the shares at their market price, he was about £1,300 out of pocket. With regard to the Limited Company, he had abstained from pressing for the amount due to him, in order to enable the shareholders to receive as much as possible.

The Witness then proceeded to make a lengthy statement by way of re-examination. He referred to various testimonials which had been received from Government officials and others as to the excellence of Woodhouse & Rawson's lamp, and added that the firm for some years prior to the formation of the company was practically without a rival in certain departments of electric work. They had also an exceptionally sound class of customers, as was shown by the fact that the bad debts made by the firm during six or seven years only amounted to about £200.

His Honour observed that he should be glad to hear any remarks which the witness had to make upon the question whether proper

disclosure was made in the prospectus, or otherwise, of the financial business contemplated by the company, as in his opinion this was one of the most important points of the enquiry.

Replying to questions by the Registrar, the Witness said that the option for the call upon the Elmore shares, which was handed over by him to the company without any consideration, eventually proved to be worth £35,000. With the exception of about £200 which he received from the Phœnix Trust, he did not receive directors' fees from any of the four companies with which he was connected as representing the United Company. He had made himself liable on behalf of the company to the extent of £19,000 at one time, and at the date of the winding up he was liable to the amount of £10,000.

By Mr. H. G. Rawson: He altogether denied that Woodhouse and Rawson had ever been promoters in the ordinary sense of the word. They were not like the ordinary promoter who brought out a new concern every month, and so long as he made a profit on it did not care what became of the company. At the time of the formation of the United Company they were possessed of patents of great value, but he explained to the directors that the only way in which the large capital required to bring out those patents could be obtained was to sell them to other companies. At the time when £2 Elmore shares ran up to £8, a number of similar businesses were brought to the company, and they gradually came to make a specialty of investigating any invention or process connected with electricity with a view to its being offered to the public. They had never had anything to do with any business which was not closely connected with electric work, and did not take up any process until they had had it under their observation for months. Upon the formation of the United Company he told the directors that he saw his way, with the help of the financial business in hand, to pay a dividend of 15 per cent. during the next three years. At the end of that period he considered that the industrial business alone would be yielding 5 per cent., which, with the help of the reserve fund, would enable the same dividend to be paid. There was absolutely no foundation for the suggestion that the firm of Woodhouse & Rawson was insolvent before the formation of the company. The large losses made by the Manufacturing Company in 1889 were due to the difficulties which had arisen in connection with the Edison and Swan Company. He had been informed by the brokers that the only reason why the capital of the United Company was not fully subscribed was, that the issue of the prospectus had been unduly delayed. As a fact, the requisite amount was reached two days after the date of allotment. He entirely denied that the directors had been in any way "rushed" in proceeding to allotment. It was necessary, however, that the company should be brought out before the August Bank Holiday, and there was a certain pressure during the three days preceding the issue of the prospectus, but this was chiefly due to the unusually long time which had been taken by the proposed directors in investigating all matters connected with the new company. As a matter of fact, all the important points connected with the company had been under discussion for some months previously, and the directors had had the fullest opportunity of obtaining the information they required. With regard to the Elmore Company, he (witness) was convinced that the shares would ultimately attain the value at which they had been taken in the balance-sheet. The present position was that, by means of the process, the amount of gold and silver extracted more than defrayed the costs of working, and the company were thus enabled to produce, without expense, copper of a quality much superior to that obtainable by any other process.

The examination was further adjourned to Wednesday.

His Honour observed that he hoped it would be found practicable to conclude the examination at the next sitting. Should any person interested in the enquiry desire, upon going through the evidence, to have an opportunity of making a further statement or putting further questions upon any point affecting him, he would be at liberty to apply to the Court to grant a special sitting for that purpose.

The examination was resumed on Wednesday last.

Mr. F. L. Rawson again went into the box, and asked to be allowed to put in a written statement dealing with the whole history of the company. As the statement, which was of a very voluminous character, was not yet in a complete form, he suggested that the whole document should not be read, but that he should be allowed to put it in as it was, and to give evidence supplementing any points which required further explanation.

Mr. Stewart, the Official Receiver, observed that this would be a very inconvenient course to adopt, and after some discussion it was agreed that Mr. Rawson should be allowed a further three days in which to complete his statement, and that it should then be formally put in and sworn.

In answer to Mr. Jenkins, on behalf of directors, Mr. Rawson said that the 25 founders' shares in the Phœnix Trust Company were valued in the balance-sheet of June, 1891, at £15,000. He (witness) was convinced at the time that if the Phœnix Trust had gone into liquidation next day, the United Company's interest in the shares would have been valued at over £15,000. The directors, in fact, could have wound up the Trust at that time, if they had so desired, but they did not do so, because the Trust was at that time bringing out the American Elmore Company, from which a large profit was expected, and eventually realised. With regard to the value put upon the Epstein shares in the same balance-sheet, he was asked by the board if he could obtain an expert valuation of these securities, but he was unable to do so. Personally, he was fully satisfied that the figure at which the shares were taken was a fair one, and in fact, he himself offered to buy £3,000 worth of the shares at par. The shares in the Sociedad Espanola were taken in the balance-sheet at the figure at which they were quoted on the Barcelona exchange, as reported to the company by their agent in that city. As regards the general conduct of the company's business, he (Mr. Rawson) devoted himself mostly to the work in connection with patents, and to what has been called the financial branch of the concern. The attention of the other directors was given almost entirely to the industrial part of the business, and to endeavours to get the affairs of the old company wound up in a satisfactory manner. It was a fact that Sir John Stokes and Sir R. Rawson were the directors specially charged with the direction of the industrial department of the company's business.

Replying to Mr. Pilling, the Witness said that the option to a call on the Elmore shares, which eventually proved to be worth £35,000, was given up by him originally for the benefit of the Limited Company. The directors of the United Company afterwards claimed to be entitled to the option, and after considerable negotiation it was made over to them.

No other creditors or contributories desiring to examine the witness, the inquiry was then ordered to be concluded.

In answer to Mr. Stewart, His Honour said that the statement of Mr. Rawson, when completed, could be brought to him (the Registrar) in chambers, and could then be formally sworn and put in. The statement could then be examined by all the persons concerned in the present enquiry, and if either they or the Official Receiver desired to ask any questions upon it, a further sitting would be granted for that purpose.

Andrews & Preece, Limited.

In the Chancery Division of the High Court on Saturday, before Mr. Justice Chitty, the case of the Halifax and Huddersfield Banking Company *v.* Andrews & Preece, electrical engineers, of Bradford, came on for hearing on a motion for judgment in default of defence. The defendants had borrowed money from the plaintiff bank, secured by debentures giving a charge upon the property and undertaking of the company.

No opposition was made to the motion, and His Lordship made the usual order.

ELECTRIC EXECUTIONS.

W. de Fonvielle gives, in *La Lumière Electrique*, a summary of a paper read on June 3rd before the Academy of the Moral and Political Sciences, treating of the infliction of capital punishment by electricity instead of the guillotine. The late E. Charton (?) who disapproved *in toto* of the penalty of death, proposed to abolish the publicity of executions, and to adopt electric shocks or current as the agency to be employed. He consulted some of the most eminent *savants* of France—Berthelot, Bertrand, and Jamin—on the practicability of the second item of his project. All the experts replied that energetic currents can be managed with the certainty requisite to strike the criminals with the rapidity of lightning, and to annihilate life without the least pain.

At the instigation of Charton, the late illustrious physiologist Brown-Sequard, proposed to perform the indispensable preliminary experiments upon oxen and horses. But the Minister of the Interior found that he had no power to sanction the necessary outlay.

In the meantime, however, the costly experiments were made in America by Edison, and on the faith of the results obtained, the Senate of New York decreed that after January 1st, 1889, all executions within the jurisdiction of that State should be effected by means of electricity.

One Kemmler, a murderer of the vilest type, was the first who was to be fulminated out of existence. But in America there is many a slip between the death sentence and its execution. For 18 consecutive months (!) justice was baffled by appeals, and it was only on August 8th, 1890, that Kemmler was eliminated.

It may be very naturally asked who found the funds for this prolonged quibbling? We must own with regret that the manufacturers of the alternating current machines stooped to this mean stratagem. They feared, or professed to fear, that the sale of their apparatus would fall off if the public learned that they could extinguish life with the rapidity of thought.

The execution of Kemmler did not take place without some difficulties. The irritated American Press, being legally forbidden from giving any details of the execution, braved the penalties thus incurred, and gave the most exaggerated and distorted accounts of the slowness of the operation, and the (probable?) sufferings of the villain. Since that day the arrangements have been improved.

Dr. McDonald, instructed by the State Government to direct the seven first electric executions, and to undertake the autopsy of the bodies, reports formally that there is no lesion

visible to the naked eye. The tissues are not burnt or scorched at the spot where the epidermis is in contact with the electrodes. "*It is without doubt that this method of inflicting death is the most rapid, certain, and the least painful and repugnant which can be imagined.*"

The Press of New York, which was at first bitterly hostile to this method of execution, has now seen reason to alter its views.

CORRESPONDENCE.

An Examination Question.

The following question was recently put to a candidate for the post of electrical engineer to one of our large steamship companies :—

"Suppose a dynamo on board ship is loaded with 200 lamps and is able to run them at 60 degrees without undue heating or sparking. What percentage of the lamps should be turned off while the ship is in a hot climate, say in the Red Sea, when the average temperature of the whole circuit may be 120 degrees? Show how the percentage is arrived at."

In the absence of any data as to the temperature that the armature is allowed to rise to, or the hot and cold resistances of it say, will any correspondent show how the above is to be answered, without making any assumptions, further than what is contained in the question.

J. W.

[The above is an absurd question. In order to fix the maximum load on the dynamo placed in an atmosphere of a given temperature, the highest limit to the temperature of the armature must be stated, also the rate of generating heat in the armature ascertained and its rate of cooling measured or calculated from dimensions, speed, and ventilation, none of which are stated in the question.

Dynamos on board ship are usually independent of external climate, being as a rule in the engine room where the temperature is quite as great all the time and in any climate as it is in the Red Sea. We have seen dynamos near the boilers in some ships, always at the high temperature named.—Eds. Elec. Rev.]

Japan Cables.

In the current issue of your paper I find a paragraph, with no mention of the source whence it emanates, which states that "cable communication with Japan is interrupted," and that "the cables of the Eastern Extension Company are at present the only means of communication with China."

Both these statements are entirely erroneous. Communication both with China and Japan viâ this company's route is in perfect order, and there has not been any interruption of the cables for some considerable time.

I am surprised to find such statements published in your journal, as by application at this office you could have immediately obtained correct information as to the state of the lines.

F. C. C. Neilsen, *Manager,*
Great Northern Telegraph Company.

August 3rd, 1894.

Electrical Distribution by Alternating Currents.

A few days ago I saw a description of the Lowrie compound intraposed automatic system which has been mentioned several times in your journal. Without going into any lengthy discussion of the system itself, I should like to point out that the automatic switch, the main feature of the system, is not likely to work at all. When the switch is off the controlling electro-magnet is practically a transformer, the primary and secondary of which are wound on two separate cores hinged together in one end and with pole-pieces in the other end making a complete magnetic circuit. The secondary winding is short-circuited. The action of the switch depends on the supposed repulsion between the two pole-pieces when the primary coil is subjected to an alternating pressure. But the pole-pieces will never repel each other, they will continue to be poles of opposite sign and attract each other in spite of the secondary current; the primary coil will take a heavy current as well as the secondary, and if the resistance of the coils is not sufficient to keep the current within safe limits the result will simply be a burn out. The induction in the secondary or primary core is not due to the secondary or primary current only, but to the combined action of both and not in step with either of them. If these lines could induce the inventor or other advocates of the system to make a simple experiment to test the principle of the switch before wasting time and money on the system they will have served their purpose.

S. A. Faber.

The Physiological Effects of High Frequency High Potential Currents.

With reference to your remarks on this interesting subject on pages 124 and 125 of your current issue, may I be allowed to point out that we have at present no reliable data at all as to the voltage and ampèrage of the so-called high frequency currents that are obtained from the intermittent oscillatory discharges of Leyden jars. The quantity and potential curves of these currents bear practically no similarity to the regular sine curves produced by alternate current dynamos, and, consequently, measuring instruments and methods of calculation, which may be accurate with the latter, are absolutely of no use at all when employed with the former.

In fact, at present, no instruments exist that are capable of measuring, even approximately, the correct ampèrage or voltage of Leyden jar discharges, and any conclusions based upon treating these discharges, or currents induced by them, as comparable to ordinary dynamo alternating currents must be altogether misleading.

A. A. C. Swinton.

Alternating Current Distribution.

The case of loss to which you refer in the article in your issue of July 27th, which describes the drop in a house service under conditions in which the two conductors were laid in separate wrought-iron pipes, was that of the first house connection to a customer (the Mansion House itself excepted) joined up for the City of London Company, in January, 1892, namely, to Messrs. Mappin & Webb, from temporary mains in the Queen Victoria Street subway, and from the temporary system of supply inaugurated by the pioneer companies.

The details of the results were communicated at the time by me to Mr. Preece, and by him to the Institution of Electrical Engineers.

It was not a want of knowledge of the results on the part of the superintendent, who was Mr. G. H. Nisbett, but one in which, owing to the construction of the subway, the foreman had found that the use of two pipes was more convenient than one.

His mistake was naturally at once discovered by the loss of voltage when the load came on.

C. E. Webber.

NOTES.

Electric Tramways in Colombo.—It is stated that proposals are before the Municipality for constructing an overhead electric system in Colombo, but that the public are against it. The applicant defends this system as the most successful, practical, and economical of all electric tramways.

Electric Light at Ceylon.—An Indian exchange states that following up the trial installations in Colombo, which from all accounts were successful, several hotel proprietors, mill owners, and the Harbour authorities, intend illuminating their premises with electric lights; proposals are also before the Municipality for lighting the whole town of Colombo.

British Association.—The British Association opened its meeting at Oxford on Wednesday, when Lord Salisbury delivered his presidential address. Yesterday morning Sections A and G commenced their sittings. There was a large assembly to hear Prof. Rucker's address in Section A, after which papers were communicated by Lord Kelvin and Prof. Oliver Lodge. That of Prof. Lodge was on "Photo-electric Leakage," and was distinctly interesting, and would have provoked a useful discussion had time permitted. It is anticipated that papers of more than average interest will be brought before this section, but purely electrical communications will not be numerous. To-day, joint discussions with Section G, on "Integrators and Flight," are to be held, and they are expected to be full of interest. Little has been done in Section G. Yesterday, Prof. Kennedy's presidential address promised to exhaust most of the day's sitting. Monday is to be set apart in this section for the reception and discussion of electrical papers. The programme, however, at the present moment is not extensive, the most important papers set down being two papers by Mr. Preece on "The Efficiency of Glow Lamps" and "Signalling without Wires," and one by Mr. T. Parker on "The Oxford System." Papers on "Engine Hunting," by Mr. Swinburne, and "Steam Losses," by Mr. Hudson Beare, will, however, be interesting to electrical men.

Coast Communication.—In the House of Commons the other day, Mr. Bryce, in answer to Major Jones, said:—"The whole subject of electrical communication between lightships and the shore is now being dealt with by the Royal Commission on Electrical Communication with Lighthouses and Lightvessels. I understand that a number of inventions, including various modes of applying swivels, for establishing electrical communication between lightships and the mainland have been considered by the Royal Commission, and I would refer the hon. member to the paragraph at the top of page 8 of their second report, dated March last, in which the Commissioners state that, in their opinion, none of the inventions which they have considered are preferable to the system known as the 'sunk' system, which has now been applied to the Goodwin and Kentish Knock Lightvessels. I have no doubt that the Royal Commission will consider, and, if necessary, test, any inventions brought before them which appear to them to be superior to the 'sunk' system."

Electric Lighting of Warwick Castle.—Messrs. Edmundson, Limited, of Westminster, have been instructed by the Earl of Warwick to instal the electric light at the Castle.

The Compulsory Purchase of Industrial Undertakings.—The *Economist* last week dealt with the recent decision of the House of Lords in reference to the purchase clause in the Tramways Act, 1870. "Since, however," says our contemporary, "a very similar clause exists in the Electric Lighting Act, 1882, it is desirable that no such dubiety should obtain in regard to it as appears to have been the case with the Tramways Act, and that shareholders in electric lighting companies should be fully informed as to the position between the companies and the local authorities. Clause 27 of the Act referred to declares that the local authority may require the company to sell at the expiration of 21 years from the date of the provisional order, or within six months after the expiration of every subsequent seven years, 'upon terms of paying the then value of all lands, buildings, works, materials, and plant of such undertakers, suitable to and used by them for the purposes of their undertaking within such jurisdiction, such value to be in case of differences determined by arbitration. Provided that the value of such lands, buildings, works, materials, and plant shall be deemed to be their fair market value at the time of the purchase, due regard being had to the nature and then condition of such buildings, works, materials, and plant, and to the state of repair thereof, and the suitability of the same to the purposes of the undertaking, and, where a part only of the undertaking is purchased, to any loss occasioned by severance; but without any addition in respect of compulsory purchase or of goodwill, or of any profits which may or might have been or be made from the undertaking, or of any similar considerations."

Church Lighting.—Although the installation at the Leeds Parish Church is not yet complete, the electric light was in use on Sunday evening last, and the change met with much approval.

Blackpool Electric Works.—A complaint was made at the Blackpool Town Council meeting on Tuesday that serious attempts had been made to interfere with the electric light supply and the running of the electric tramway during the busy season. A local paper states that an attempt had been made to run the tramway current to earth, and to otherwise hamper the staff, the interference being of so damaging a nature that a special watch would have to be maintained.

Congratulations!—The junior partner in the well-known firm of Messrs. B. Verity & Sons is honoured by *Punch* in last week's issue as follows:—"Sortes Aquaticæ;" or, Maxim for the Maidenhead Regatta:—After a rattling race with Kilby of Staines (who was worn to a standstill), and Cohen of Maidenhead (who pitched overboard), Verity of Weybridge easily retained the Upper Thames Single Punting Championship. Why, cert'n'ly. What says the old Latin saw? *Magna est Veritas, et prævalebit!* Which (obviously) means:—Great is Verity, and he shall prevail!"

The Telephone Tubes in the City.—We are glad to observe that the Commissioners of Sewers have reconsidered their decision regarding the telephone tubes laid by the City of London Electric Lighting Company, Limited, when putting down the electric lighting mains. It will be remembered that when last the matter was before them, the majority was not sufficient to allow the resolution to be put into practice; but at the Commissioners' meeting last week the majority secured was the necessary two-thirds, so that the drastic resolution passed on July 25th, 1893, has now been rescinded. If our readers refer to page 82 of the Electrical Review for July 20th, 1894, they will be able to comprehend the present situation regarding these telephone tubes.

The Elements of Quackery.—We desire to draw attention to a loose two-page advertisement sheet of Dr. Carter Moffat's feather-weight electric body belt which disfigures the novels issued by a certain firm. On the front page there are some dozens of maladies to which poor suffering humanity is subject, some of them known to be incurable, yet the London Health Electrical Institute, Limited, has the audacity to publicly state that all these complaints may be permanently cured by wearing one of these agreeable and comfortable health-giving appliances. Thousands of muscles and nerves respond, it is said, to the healthful, invigorating, electrical influence of Dr. Carter Moffat's feather-weight electric body belts, a statement which we deny point blank. "They invigorate and tone up the system, and may be relied upon not only as a preventive against every form of ailment, but to *impart new life and energy* to the whole system," are statements, again, which are as distinctly wrong as that "all nervous and organic derangements arising from impaired vitality or defective organic action which completely baffle ordinary treatment, readily yield to the magic influence of electricity as generated by Dr. Carter Moffat's feather-weight electric body belt." An extract from the summing-up of Mr. Justice Charles, in the case of Brasyer *v.* Harness and others, might just now usefully and profitably occupy the serious thoughts of Carter Moffat and his associates:—"It was not denied that the connected belt might produce a current of electricity; but the point was that the plaintiff said defendants held out this belt as a competent appliance to cure disease. It was not sufficient to find that the belts were electrical appliances; the defendants had advertised them as appliances which would cure innumerable diseases. Could any human being, in his senses, suppose that all these diseases yielded, or could yield, to this treatment? One of the charges made was not that a current of electricity was not produced, but that the public and Colonel Brasyer were informed that these electrical appliances could cure—or alleviate, if they did not cure—pretty well every ailment that flesh was heir to. Was it not an element of quackery that the same remedy should be advertised to cure so many various diseases?"

Electrician Wanted for Bolton.—The Town Council have lately advertised for an electrician at a salary of £110 per annum.

Ourselves v. Harness.—In the Queen's Bench Division of the Royal Courts of Justice, Mr. Justice Hawkins will deliver judgment this morning at 10.30 in the "Maintenance" case, which we brought against Mr. C. B. Harness.

Melbourne (Victoria) Electric Lighting.—Mr. A. J. Arnot has been re-engaged by the City Council as electrical engineer to the council for three months, dated from June 9th, at his previous salary.

Newcastle and the Electric Light.—Prof. Kennedy has been engaged to report regarding the advisability, or otherwise, of the Corporation undertaking electric lighting in the city.

Portsmouth Electric Lighting.—Last week a deputation from Islington Vestry paid a visit of inspection to the Portsmouth Electric Lighting Works. The Portsmouth Town Hall Committee have been authorised to advertise for tenders for purchasing the electrical plant in that building, it having become unnecessary owing to the electric lighting station having been opened.

Lightning Arresters.—An accident of a rather unusual character was recently caused by lightning at the Norfolk Dockyard, U.S.A. Lord Kelvin has written the following letter on the subject to Rear-Admiral J. A. Fisher, C.B. :—"With reference to the recent report of a lightning discharge in Norfolk Dockyard, U.S.A., by which two men were killed, it is proved by that accident that to secure against danger to men working under a ship in dry dock there ought to be a thorough metallic connection, by wire rope or otherwise, between several points of the ship's iron, such as bollards, ring-bolts, &c., and iron pipes leading to the water outside the dry dock. Similar precautions ought to be taken in respect to the frames of ships on the stocks in the course of building, although we have, so far as I know, never heard of an accident from lightning happening to men at work in the building of ships. An iron ship simply resting on wooden blocks, and without any connection by metal with the water of docks, or river, or sea in the neighbourhood, is certainly dangerous to persons standing on the ground and touching any part of the iron hull during a thunderstorm." A contemporary remarks that precautions of this character are to be adopted in all the Government dockyards.

An Electrical Engineer Wins the Dunmow Flitch.—One of the Dunmow Flitches has been won by an electrical engineer and his good wife, Mr. and Mrs. Angelo Fahie, of Dublin. Never before in the history of this ancient custom has an electrical engineer gone the whole hog, as it were, and carried off the side of bacon. As a matter of fact, he has never before competed, the one and only obstacle being the want of time to run down to Dunmow. Now, however, that electrical business is becoming more or less settled, electrical engineers may, among other things, be turning their attention to the competition for the Dunmow Flitch. For the benefit and guidance of those who desire to emulate Mr. Fahie's achievments, we would mention, though to many it will be unnecessary, that the old yearly custom at Dunmow is that of presenting flitches of bacon to the married couples proving to the satisfaction of a judge and jury of maidens and bachelors, that "for the last twelvemonth and a day they have not offended each other in thought or deed." We believe that the wedded couple, for some part of the ceremony, kneel on sharp stones; but that's only by the way, or like the odd day above mentioned, thrown in. It is not that the intrinsic value of the bacon is high, nor that the sharp stones offer any attractions for weak-kneed humanity, but to be able to say that after being coupled in parallel and synchronising for twelve months and a day you hav'n't fallen out of step, is surely an achievement not altogether beyond the aim of electrical engineers. We hope that next year the custom of the Dunmow Flitch will be properly catalogued in the festivities of electrical engineering societies.

Electric Light in Cowes.—The Marine Hotel has been lighted by electricity.

Theatre Electric Lighting.—Wigan Royal Court Theatre has lately been altered and enlarged. An electric lighting installation is numbered among the improvements.

Appointment.—Mr. R. A. Chattock, who has been superintendent engineer at the Amberley Road station of the Metropolitan Electric Supply Company for two years, has now been appointed chief electrical engineer to the Hampstead Vestry.

Worcester Electric Lighting.—At the Watch Committee meeting last week, the Mayor announced that he had been in communication with Mr. Preece, and with the Brush Company, about the opening of the central station, and October 11th had been fixed for the opening ceremony.

The Electric Light at Hull.—Mr. A. H. Gibbings (the engineer) has presented a report to the effect that "there was every indication that the maximum demand for current from their station would be greater towards the end of this year than they were able to supply with the whole of their present plant. He therefore recommended the committee to consider the advisability of extending the plant, and putting down two additional engines and dynamos." The report has been adopted, and the committee have resolved to ask the council to allow them to spend £2,800 for the increase of plant.

Copper for Nothing.—It will be seen from a perusal of the public examination of Mr. F. L. Rawson, on page 170, that the present position of the Elmore Copper Company is represented by him as one of defraying the costs of working from the amount of gold and silver extracted, so that the company produces its copper without expense. It is curious that Mr. Rawson can seriously make statements of this kind with the idea that they possess any value. Everybody knows the history of the Elmore business, and everybody is also aware that competing electro-depositing firms have the same chance of extracting gold and silver.

Pacific Cable Question.—Telegrams dated 6th inst. from Ottawa states that, under the authority given it by the recent Inter-Colonial Conference, the Canadian Government is inviting tenders from cable manufacturers for the laying and maintenance in an efficient condition of a cable across the Pacific from Canada to the Australasian Colonies. Offers will be received to November 1st next.

The following announcements are made regarding certain representatives who were present at the Conference at Ottawa :—Sir Henry de Villiers, one of the South African delegates to the Ottawa Conference, has arrived in London on his return from Canada. The Hon. A. J. Thynne, M.L.C., of Queensland, and delegate to the Conference, has reached London, and will shortly proceed to the colony. Sir Adolphe Caron, the Postmaster-General of Canada, and vice-president of the conference, has also arrived in London.

An Electrical Fire-damp Detector.—It is a well known fact that a spiral of platinum wire that has been heated to redness glows more brightly when it is plunged into a vessel containing air mixed with inflammable gas. This forms the basis of a method of detecting fire damp in coal mines, which has been worked out by G. Fletcher. The method involves the use of an instrument, which consists of two identically similar spirals of fine platinum wire, one of which is enclosed in an air-tight tube containing air, and having the upper end glazed, whilst the other is contained in a similar tube of wire gauze, which is also glazed at its upper end, both tubes being arranged vertically. When a current of electricity is passed through both spirals in air, they glow with equal brilliance; but when the instrument is introduced into an atmosphere containing inflammable gas, the spiral in the wire gauze tube glows the more brilliantly, the brilliancy being proportional to the amount of inflammable gas present. By an ingenious arrangement it is possible to calculate very easily the actual percentage of dangerous gas that happens to be present. This arrangement is based on the principle used in common photometers. Any small storage battery, such as those in use for miners' lamps, may be used as the source of electricity.

Gas and Electricity at Taunton.—The local gas company finds that, despite the opposition of electric lighting, the consumption of gas has materially increased.

Coupled Up.—Mr. J. E. Edgcome, electrical engineer to the Kingston Town Council, was the other day presented by the members of the Lighting and Drainage Committees with a silver salver on the occasion of his marriage. Messrs. G. E. Belliss & Co. and others also made presentations. Mr. Edgcome has our hearty good wishes.

The Electrical Purification of Water.—It is universally agreed that an excess of calcium and magnesium sulphates and carbonates is not a desirable accompaniment of potable or industrial waters. Most of the processes which have been proposed for the elimination of these substances are of a chemical nature, and not only costly, but somewhat inefficient. Mons. Villon has described an electrolytic process which is much less expensive to work, equally effective, and yet requiring no continuous surveillance, because the amount of the necessary reagents produced by the electric current is always equivalent to the compounds to be precipitated from the water. Moreover, no trace of the reagents remains in the water; and this is rarely the case when chemical processes are resorted to. The system is as follows:—Having determined the percentage of the magnesium and calcium salts which the water contains, an equivalent quantity of nitrate of soda is added. The water is then submitted to the action of the electric current, lead electrodes being used. The effect of the current is that caustic soda is liberated at the negative pole and nitric acid at the positive pole, which latter must be renewed from time to time, for the nitric acid attacks the electrode, forming lead nitrate, calcium, and magnesium carbonates, and sulphates are precipitated by the caustic soda, sodium sulphate and carbonate being thus produced; the sodium carbonate then precipitates the lead nitrate. About 250 litres of water can be purified in an hour in the plant described by Mons. Villon; and the most extensive experiments described refer to the treatment of 20 cubic metres of water per day at a cost of 5 centimes per cubic metre. The precipitates referred to above settle quickly, and the clear water can then be drawn off.

An Improvement in the Manufacture of Carbons.—In illustration of a practical advantage accruing as a direct result of a piece of pure research, the following may be noticed: MM. Despretz and Berthelot described before the Paris Academy of Science some time ago some experiments which they instituted with the object of studying the conditions under which carbon fuses and sublimes. *Inter alia*, they discovered whilst engaged in this investigation, that when exposed to the action of high temperatures the various kinds of carbon pass into the graphitic condition. This result possibly did not strike anyone at the time as being capable of commercial application; it appeared what it professed to be, a piece of pure research. MM. Girard and Street, however, have succeeded in basing upon this result the manufacture of graphitic carbon suitable for various electrical purposes. Carbons made in the ordinary way are subjected to such a temperature as will soften, weld, and even fuse and sublime the material. The temperature is kept up until they are converted into graphitic carbon or graphite. To obtain the necessary heat, the carbon that is being converted is made part of an electric circuit, or else an arc is caused to play over its surface, in which case the graphitic character is produced to a certain depth. Granular and powdered carbon is similarly altered by passing it between electrodes, the rate of flow being adjusted so that the whole of it is brought up to the requisite temperature. Such graphitic carbon may be used in the manufacture, by agglomeration, of the various "carbons" which are used in electrical work. The moral to be drawn from this is obvious. We have constantly urged our readers to study the results obtained in pursuit of pure as distinct from applied science; for a result to a theorist is too often merely a contribution to knowledge, and it usually requires the commercial instincts of the "practical man" to recognise the utilitarianism underlying the isolated fact. Those of our readers who are apt to skip the short notices of recent research which we give from time to time, may perceive in MM. Girard and Street's application of MM. Despretz and Berthelot's results a suggestive object lesson.

Common Knowledge.—Is Mr. Justice Romer (see page 167) correct in saying "knowledge in the United States is not knowledge here?" All American patents can be consulted in the English Patent Office, and surely anything extensively operating in the States in any branch of industry is well known to people in other countries who are interested in similar undertakings. To accept Mr. Justice Romer's statement as a fact would lead to more patent piracy than now exists.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

West Coast of America Telegraph Company, Limited (11,933).—The whole of the nominal capital of this company, £300,000, in £10 shares, has, according to the latest yearly return, dated the 12th ult., been taken up and paid in full.

Thetford Electric Light and Power Company, Limited (31,770).—The annual return of this company, although made up to September 30th last, has only recently been filed. From it, it appears that out of a nominal capital of £5,000, in £10 shares, 368 shares have been taken up, upon which the full amount has been called. The total received is £3,615, and £65 is outstanding.

Allen Everitt & Sons, Limited (31,632).—The registered office of this company is now at Kingston Metal Works, Smethwick, near Birmingham.

Weymersch Electric Battery Syndicate, Limited (32,858).—This company's yearly return was filed at Somerset House on the 28th of last May. It shows that out of a nominal capital of £20,000, in £5 shares, 4,000 shares have been taken up, and that the full amount has been called on 1,000 of these. A sum of £5,000 has been received, and £15,000 has been agreed to be considered as paid.

Woking Electric Supply Company, Limited (29,047).—The registered office of this company is at Board School Road, Woking.

Scottish House-to-House Electricity Co., Limited (29,232).—This company's annual return was filed on February 15th last. It shows that out of a nominal capital of £100,000, in 19,900 ordinary and 100 founders' shares, all of £5 each, 1,629 ordinary shares have been taken up, and that the full amount has been called on each. A sum of £3,528 has been received; £5,592 is outstanding, and £975 has been forfeited on 1,950 shares.

Tayler Smith Electric Company, Limited (34,454).—This company's yearly return was filed on June 27th last, and shows that out of a nominal capital of £6,000 in 300 preference and 300 ordinary shares, all of £10 each, the whole of the latter, and 299 of the former class, have been taken up. A sum of £2,980 has been received, £10 is in arrear, and £3,000 has been agreed to be considered as paid on the ordinary shares.

George Moritz, Limited (38,158).—The annual return of this company shows that out of a nominal capital of £5,000, in £1 shares, 1,009 shares have been taken up, and that the full amount has been called on each of these. A sum of £9 has been received; and £1,000 has been agreed to be considered as paid.

William Houghton & Co., Limited (38,211).—This company's yearly return was filed on February 19th last. From it, it appears that, out of a nominal capital of £10,000, in £10 shares, 396 shares have been taken up, and that the full amount has been called on these, which results in a total payment of £3,960.

Froggatt's Inventions Syndicate, Limited (40,231).—According to a letter filed at Somerset House on May 28th last, the above company is defunct, no business having been done.

Froggatt's Electric Lighting Company, Limited (40,321).—This company's capital has been increased by the addition of £57,000. The original capital was £3,000, divided into £1 shares.

Oriental Tube Company, Limited (36,251).—This company's return was filed on June 20th last. It shows that out of a nominal capital of £30,000, in £5 shares, 1,893 shares have been taken up, and that the full amount has been called on each of these. There has been received a sum of £9,465.

BUSINESS NOTICES, &c.

Woking Electric Lighting.—In the minutes adopted by the Local Board recently were the following particulars:—At a meeting of the Sanitary and Lighting Committee held on July 19th, tenders for lighting the Woking Station and Maybury Ward were opened.

Messrs. New & Mayne (electric light).—Capital expenditure for 34 single and 13 two-light lamp columns, £400, or for 48 single and 13 double-light columns, £513 15s.; current, &c., to 60 incandescent lamps, each of 25-candle-power, £252, or for 70 lamps, £310 16s., capital to be repaid within five years, with interest at 5 per cent. per annum.

The Woking District Gas Company (gas).—Capital expenditure for 100 street lamps, £300; current, &c., to same for 2,000 hours per annum, £265; agreement for three years and subject to six months' notice, interest on capital expenditure 5 per cent., 2½ per cent. per annum discount to be allowed for depreciation.

The clerk was instructed to write to Messrs. New & Mayne, inquiring (1) whether they would be willing to make a proportional allowance if the Board do not require 2,000 hours' installation and charge a proportionate increase for any further lights that may be required; (2) whether, as they proposed to charge interest at the rate of 5 per cent. per annum for capital outlay they would, as in the case of previous tender, be willing to make an allowance of 2½ per cent. per annum for depreciation, if and when the Board take over the plant; (3) whether they would be content to extend the period of purchase from five to seven years; (4) within what period could they complete the installations? The clerk was also instructed to write to the gas company as to extending the period of purchase to seven years, and the period by which they could complete the installation. Another meeting of the committee was held that day (July 23rd), when it was resolved that the tender of Messrs. New & Mayne be recommended to the Board for acceptance; that 48 25-candle-power lamps be provided, and 13 two 25-candle-power lamps be provided; capital cost £513 15s., or cost price after giving credit for all discount. Messrs. New & Mayne to be allowed 20 per cent. for establishment charges, &c. The committee recommend the latter offer for acceptance. Capital to be repaid at the end of seven years, less 2½ per cent. per annum for depreciation; interest at 5 per cent. per annum on capital expenditure to be paid by Board; cost of current for 2,000 hours per lamp with proportionate allowance, £310 16s.; minimum of 1,000 hours per annum per lamp. The committee further recommend that the Board authorise this committee to settle the actual terms of contract, and arrange for the immediate carrying out of the work, and that the clerk be authorised to instruct counsel to settle contract and advise thereon, as necessary. This report has been adopted.

Bankruptcy.—At the Leeds Bankruptcy Court on Thursday last week, application was made to his Honour, Judge Gates, Q.C., for the discharge of Edwin Moorhouse, electrician, of Leeds. The receiving order was made in respect of the debtor's estate on October 21st, 1891. "Heavy costs of litigation as to interest under his father's will, and interest on mortgages," was stated to be the cause of the debtor's failure. He commenced business in October, 1889, when he took a partnership in the firm of "Mori & Co.," electricians, of Leeds, and paid £600 as his share of the capital. In giving his decision, his Honour pointed out that the assets of the debtor had not amounted to 10s. in the pound. True, it was in the belief that he would receive the £3,000 that he had continued the business, but a similar argument might be applied by bankrupts to bad debts. The certificate was suspended for two years.

The failure has been announced at the London Bankruptcy Court, of Arthur Shippey, described as an electrical engineer, of 13, King Street, Cheapside. The receiving order was made on the application of Messrs. Garnett & Harrison, acting on behalf of creditors, and no particulars transpired.

Derby Electric Lighting.—The Electric Lighting Committee, in their last report, state that the electric light mains have been ordered to be extended in several places to meet the requirements of new customers. Forty meters have been ordered at a cost of about £300. Mr. Moore, the assistant engineer, has resigned his position, and an advertisement has been published for a successor. The Electric Lighting Exhibition, which was held in May, was well patronised by the public, and the great variety of uses and advantages of electric light were well demonstrated. The cost of the exhibition to the Corporation is £76 17s. 1d., which is less than the amount first contemplated. No charge is included in the above for current, which at the ordinary rate would amount to about £45.

Dundee Electric Lighting.—In consequence of the increased demand for electric light, it has been decided that a "new battery" should be introduced at the works, the cost of which is estimated at between £1,000 and £1,500. Tenders are to be advertised for. The Clerk has been authorised to sign an agreement for the maintenance of the batteries under which they would be kept in perfect order for five years for an annual payment of £76.

Price Lists, &c.—From the Sunbeam Lamp Company, Limited, we have received a circular giving prices of their lamps from 8 C.P. to 2,000 C.P.

The Boudreaux Dynamo Brush Company, of Gresham Street, have sent us a few of their price and testimonial lists dealing with their new foliated brushes, also ammeters and voltmeters made by Messrs. Desruelles & Chauvin.

Messrs. Nalder & Harrison have brought out a list dated June, 1894, of electrical measuring instruments, which is nicely compiled and illustrated.

Messrs. Croggon & Co. have just brought out a new catalogue of electric bells and accessories, telephones, alarms, lightning conductors, &c., &c. Nearly every article described is also illustrated, and detailed prices are given.

Auction Sale.—Messrs. Fuller, Horsey, Sons and Cassell are instructed to sell by auction, in one lot, the extensive manufacturing premises at present in the occupation of Messrs. Latimer Clark, Muirhead & Co., Limited, at 23, Regency Street, Westminster, on Tuesday, September 4th at 11.30 precisely. The buildings comprise fitting shop and turnery, engine, and boiler houses, foundry, offices, &c. Among the plant and machinery to be sold separate from the premises are lathes, planing machines, screwing and slotting machines, milling and shaping machines, engines, boilers, &c., &c., and a large variety of stock materials. The sale of this part of the business will take place on the premises on the 4th, 5th and 6th of September at 11.30.

Sunderland Exhibition, 1894.—There is to be opened at Sunderland, in November next, an exhibition of marine, electrical, engineering, and general trades, industry, and art. The exhibition will remain open for two months. A special building is being erected for machinery in motion, where every facility will be provided engineers and others to exhibit their various specialities in a practical way and to the best possible advantage. The whole of the buildings inside and out, including a very powerful searchlight, will be lighted with electric light. The exhibition will be opened by the Mayor early in November, and is receiving most powerful local support and otherwise. A prospectus and plan of the exhibition is before us.

A Novelty in Lamp Shades.—We have recently seen at the showroom of Messrs. Charles Ingle & Co., 157, High Holborn, some pleasing novelties in electric lamp and candle shades, constructed of specially selected natural feathers, dyed in choice shades, and arranged in charmingly artistic shapes and combinations of colour. The shades for floor and table lamps are beautifully designed and represent various kinds of flowers grouped together on skeleton frames. The effect obtained is quite different from the somewhat Hackneyed style of silk and lace shades so much in vogue. We understand that the general construction of these shades is protected by patent, and that every design is registered.

Andrews & Preece, Limited.—An announcement in the *London Gazette* states that an extraordinary general meeting of the above company, held at the registered office, situate at Borough Mill, Manchester Road, Bradford, on July 23rd, 1894, the following extraordinary resolution was duly passed:—"That it has been proved to the satisfaction of this meeting that the company cannot, by reason of its liabilities, continue its business, and that it is advisable to wind up the same, and accordingly that the company be wound up voluntarily." And at the same meeting James Duff, of Barum House, Halifax, in the said county, Chartered Accountant, was appointed liquidator for the purposes of such winding up.

Private Installations.—Regarding the Note on p. 143 of our last issue, *re* Huddersfield Co-operative Society's installation, we learn that Mr. J. A. Edmondson, of Bradford, has just completed same, and that the dynamo was made and supplied by him. He has also several other installations on hand, namely:—For Newsome, West & Co., Limited, Dewsbury, 600 lights and dynamo; for Wheeler and Wilson, Limited, of London, both shop in Cheapside and factory at Finsbury, about 200 lights and a dynamo; for the Bradford Steam Laundry Company, Limited, Clayton, six arc lamps, 24 incandescent lamps, and a dynamo; for J. Guest & Co., Barnsley, 8 arc lamps, 20 incandescent lamps and a dynamo.

Asylum Electric Lighting.—The Royal Lunatic Asylum, Aberdeen, is at present undergoing extensive alterations involving the re-construction of the old buildings and the erection of a new hospital. When completed the whole will be lit electrically by generating plant on the premises. Messrs. New & Mayne have secured the first electrical contract placed; this is for the wiring of the new building to the plans and specifications of Dr. R. Mullineux Walmsley, of Edinburgh, the consulting electrical engineer of the Asylum Corporation.

Launch Propulsion.—Mr. E. A. McLachlan, of 55, Brighton Road, Stoke Newington, N., has invented an electrical stern attachment for the propulsion of boats without any alterations in the hull being rendered necessary. By this new arrangement any existing sailing or rowing boat can be converted into an electric launch without destroying its original character. The stern attachment, which is detachable, and which, we understand, contains an electromotor, is fixed in the place of the ordinary rudder, and the motive power is obtained from accumulators placed under the seats.

Electric Lighting at Alderley Edge.—The Local Board have decided to apply to the Board of Trade for a provisional order for supplying electric light within its district. It had been intimated that private applications were about to be made to the Board of Trade, and the Local Board now feel that it is necessary for them to apply for an order so as to protect their interests, and to prevent the powers going into the hands of private companies.

Colliery Plant.—Messrs. J. P. Hall & Co., of Oldham, have in hand a large electrical power transmission plant for a colliery, consisting of a dynamo to give 250 ampères at 600 volts when running at 400 revolutions per minute, and several motors for pumping and other purposes. The largest of these motors is of 70 brake horse-power, and will be situated at about 900 yards from the surface.

Engineer Wanted at Dewsbury.—The Corporation are advertising for a properly qualified practical electrical engineer to take charge of the new electric lighting station and works at Dewsbury. The person appointed will be required to devote the whole of his time to the duties of the office. Applications to be lodged with the Town Clerk by the 17th inst.

Electric Traction in Venezuela.—A concession has just been granted by the Venezuelan Government to an American syndicate for the construction and operation of an electric tramway between Carracas and La Guayra.

Telephonic Communication in New Zealand.—The establishment of a line of telephone between Whananaki and Hikurangi, New Zealand, is being discussed. This is held to be desirable to enable the trade of Whananaki to be developed.

New Agency.—Messrs. Elliott Bros. inform us that they have taken over the sole supply, for Great Britain and the colonies, of all the instruments for electrical measurements manufactured by the Weston Electrical Instrument Company, of Newark, New Jersey.

St. Pancras Electric Lighting.—As the demand for current in the district north of the Cobden statue has exceeded that originally contemplated, the St. Pancras Vestry have decided to expend £2,800 in putting down supplementary feeders and mains.

Salisbury Electric Lighting Matters.—The Town Council have instructed Mr. Robert Hammond to report on the proposed license sought for by the Salisbury Electric Light and Supply Company, Limited, and the various matters dealt with therein.

Bowness and Electric Lighting.—The Local Board have refused to sanction the application of the electric light company to the Board of Trade for a provisional order.

Telegraphic Communication in Tasmania.—Including those in connection with the railways, the telegraph system of Tasmania now extends to 2,811 miles.

Telegraphs in Japan.—During last year 1,184 tons of telegraph wire, valued at £12,156, were imported into Japan through Yokohama, as against 1,053 tons, valued at £11,837 in 1892.

CONTRACTS OPEN AND CLOSED.

OPEN.

Birmingham.—September 1st. Tenders invited for the electric lighting of the glasshouses at the Botanical Gardens, Egbaston, Birmingham. Further details will be found among our advertisements.

Newcastle-on-Tyne.—August 15th. Tenders are invited for the best scheme, with cost, for the lighting and heating of New Trinity Presbyterian Church, to be built, Northumberland Road. Further particulars may be obtained from the architects, Messrs. Marshall & Dick, 4, Northumberland Street.

CLOSED.

Belfast.—The Electric Lighting Committee have accepted the tender of Messrs. Marshall, Fleming & Jack, for the supply and erection of an overhead travelling crane for the central station.

Glasgow.—Messrs. Babcock & Willcox, Glasgow, have secured the contract for the additional boilers to be laid down at the corporation Electric Light Works, Waterloo Street.

Kingston.—The tender of Messrs. Robey & Co. for a gas engine for the electric lighting station at £126 has been accepted by the Town Council. Some of the arc lamps are to be removed from their present positions to more suitable places.

London, W.—For the installation of the electric light, for Mr. J. H. Renton, 39, Park Lane, W. Mr. W. J. Fryer, A.I.E.E., electrical engineer. Graham & Biddle, 463, Oxford Street, £534 (accepted).

London, W.—For the installation of electric light and various works, for Mr. Francis Samuels, 34, Bryanston Square, W. Mr. W. J. Fryer, A.I.E.E., electrical engineer. Graham & Biddle, 463, Oxford Street, £445 (accepted).

London, W.—For the installation of the electric light and organ-blowing apparatus by electric motor, for the Wardens of the West London Synagogue, Upper Berkeley Street, Marble Arch, W. Mr. W. J. Fryer, A.I.E.E., electrical engineer. Graham and Biddle, 463, Oxford Street, £189 (accepted). There were two other tenders.

Melbourne (Victoria).—The tender of Messrs. G. and C. Hoskins for the supply of 900 30-feet poles for electric lighting purposes at £1 3s. 4d. per pole was accepted; as was also an offer from the same firm to cart, erect, and paint 1,344 poles required for similar purposes at £425 12s.

Yarmouth.—The Technical Education Committee opened tenders last week as follows, for installation and supply of the electric light to the School of Art, South Quay:—Messrs. Crampton, Cambridge, £57 18s. 6d.; Messrs. Laurence, Scott & Co., Norwich, £81 16s. 4d.; Messrs. Crompton, £86 5s.; and Mr. Durrant, Yarmouth, £96 17s. 11d. The lowest tender was accepted. Messrs. Crampton have also been entrusted with the installation of the light at the Cromwell Hotel.

BOOK RECEIVED.

A Treatise on the Measurement of Electrical Resistance. By Wm. A. Price, M.A., A.M.I.C.E. Published at Oxford by the Clarendon Press.

CITY NOTES.

Crompton & Co., Limited.

The report which we publish below is not altogether a pleasing one. It bears on its face evidence of the depression which has been so long prevalent in electrical work. At the same time there is a marked disposition to meet the exigencies of the circumstances by reducing expenses. It will be seen from the parallel columns on page 177 that loans from bankers have increased considerably, and that investments in other companies are £10,000 higher than they were last year. It is impossible from the meagre information given in the report to say whether this increase in investments is a good one or not, but the directors with their knowledge of electrical work ought to be able to guard against unsafe investments.

Crompton & Co., Limited.

The directors state that the amount of the company's business has satisfactorily increased; but the net profits, in consequence of close competition, show a reduction as compared with last year, and this, notwithstanding the fact that the directors, by careful management, have reduced the expenses in many departments. The net profits for the year amount to £11,741 2s. 7d., and after providing for debenture interest, and the payments set out in the revenue accounts, there remains a balance of £6,116 3s. 5d., out of which the directors propose to set aside £1,000 for contingencies and doubtful debts, to pay a dividend of 3s. per share on the preference shares, and to carry forward the balance. The directors regret that the net profits are insufficient to allow for the full dividend on the preference shares; at the same time they do not think there is anything discouraging as to the future of the company. The works are in first rate order and condition, and under the new management the cost price of manufacture has been considerably reduced, while the various departments outside the works are at the same time being carefully reorganised with the view of reducing expenditure to the utmost without affecting their efficiency. Since April, 1891, the directors have entered into no contracts whatever under which the payments for work done were to be partly made in shares or securities, but they feel that the value of some of the securities previously taken as part payment may be considered doubtful. Recognising the necessity of reducing such doubtful assets or securities to their proper value in the company's books, they propose that an amount of £20,000 shall be written off, and to enable this to be done they have obtained the assent of the two managing directors, Messrs. Crompton and Albright, to relinquish an equal amount of ordinary shares. The effect of this transaction will not be to deprive the company of any value which the securities in question may hereafter attain, and the reduction of the amount of ordinary shares must be for the benefit of the members generally. The directors are glad to be able to report that the cooking and heating department of the company, which has been practically established during the past year, is likely, in their opinion, to prove a very valuable addition to the company's business. The directors, in response to their circulars in January last with regard to the proposed issue of £100,000 of 4½ per cent. debentures, have received promises from the debenture and shareholders of the company to subscribe for the new issue to the amount of nearly £32,000, but as this support was insufficient to enable the issue to be made with any certainty, the board considered it better to wait for the statement of accounts now presented. It is intended to take further steps to place the debentures during the ensuing autumn, but they wish to urge upon the shareholders that it is in their own interests to assist in this issue, which is of such great importance to the company. At the same time, they would remind the shareholders that the security for these debentures is undoubted. The property of the company, even after the reductions before referred to, amounts to £236,618, including uncalled capital, but without reckoning the value of patents and goodwill, and the income of the company for the last six years has averaged £11,839 per annum, while the interest required for the total proposed issue of debentures would only amount to £4,500 per annum.

STATEMENT OF LIABILITIES AND ASSETS, March 31st, 1894.

CAPITAL AND LIABILITIES.

Dr.	£	£	s.	d.	1894. £	1893. £
Authorised issue 60,000 shares at £5	300,000					
Ordinary shares, 8,000 issued as fully paid	£40,000					
Ditto 1,928 shares, £1 called ...	£1,928					
Payments in full ...	24					
		1,952				
		41,952				
Preference shares, 28,180 at £5 ...	140,900					
Less arrears	33					
		140,867				
					182,819	176,897
Debentures issued					48,810	47,805
Loans from bankers and overdraft ...					27,439	18,000
Sundry creditors					33,326	26,490
Half-year's debenture interest, paid April 1st, 1894					1,185	nil.
Doubtful debts and contingencies account					280	336
Reserve fund...					2,135	2,558
Unclaimed dividends					16	...
Revenue account balance					6,116	3,019
					£302,127	†

PROPERTY AND ASSETS.

Cr.	£	s.	d.	1894.	1893.
				£	£
Freehold property				21,358	21,254
Stock-in-trade...				58,210	64,236
Work in progress on contracts				11,048	nil.*
Plant, tools, furniture, fixtures, &c. ...				48,241	44,399
Trade debtors...				57,041	55,149
Investments in shares of other companies				13,658	12,044
Chelmsford Electric Lighting and other subsidiary companies				39,381	29,681
Cash at bankers and in office				6,060	3,044
Preliminary expenses—suspense account ...				750	900
Patents account				13,787	13,589
Electric cooking and heating department, cost of establishing				2,590	nil.
Goodwill				30,000	30,000
				£302,127	†

* Installations are given in the last account as £850.

PROFIT AND LOSS ACCOUNT for the year ending March 31st, 1894.

Dr.	£	s.	d.	1894.	1893.
				£	£
To Trading and office expenses, salaries, agencies, &c.				19,742	23,788
„ Repairs to buildings and plant... ...				1,102	1,104
„ Depreciation of plant and machinery, patents, and fixtures				4,497	3,596
„ Balance carried to revenue account ...				11,741	11,953
				£37,084	£ †

Cr.	£	s.	d.	1894.	1893.
				£	£
By Gross profit from trading account, pupils' premiums, profits and dividends on investments				37,084	40,443
				£37,084	£ †

REVENUE ACCOUNT.

Dr.	£	s.	d.	1894.	1893
				£	£
To Interest on debentures				2,365	2,183
„ Interest on bankers' advances				1,227	nil
„ Preliminary expenses (written off) ...				277	269
„ Directors', trustees', and auditors' fees				1,443	1,245
„ Income tax	310	14	2		232
„ Balance available for distribution	6,116	3	5		3,019
				6,426	
				£11,741	£ †

† We have added this column of 1893 figures for the sake of reference. They do not appear in the directors' statement.

Cr.	£	s.	d.	1894.	1893.
				£	£
By Net profit from profit and loss account				11,741	11,953
				£11,741	£11,953

J. H. DUNCAN & Co., *Chartered Accountants.*

Medical Battery Company.

MESSRS. JOHN H. LILE, A. L. Poulter, and L. J. Greenberg, creditor members of the committee of inspection of the Medical Battery Company, Limited (in liquidation), have issued the following circular:—We are glad to inform you that the Court has sanctioned a scheme of arrangement for the reconstruction of this company. The scheme provides, amongst other things, that the new company shall issue to the creditors of the old company fully-paid 7 per cent. preference shares of £1 each to the amount of their debts, and also for the issue by the new company of first mortgage debentures of £10 each to the amount of £3,000 charged on all the property and assets of the company whatsoever, bearing interest at the rate of £10 per cent. per annum, payable half-yearly, and repayable as to principal by yearly drawings of £500, the present debenture-holders postponing their security. The furniture, fixtures, electrical plant (including statical and other appliances), Zander mechanical exercises, &c., at 52, Oxford Street, and 3, Rathbone Place (exclusive of patents, leases, and goodwill), have recently been valued by Messrs. Baker and Son, of 11, Queen Victoria Street, E.C., to realise at sale by auction, £5,405.

The United River Plate Telephone Company, Limited.

THE eighth annual meeting of this company was held at Winchester House on Friday last. After taking the report, which appeared in our last issue, as read,

Mr. J. IRVING COURTENAY, the chairman, said: In reviewing the operations of the past year in the River Plate, it is satisfactory to note that the business of the company has shown a decided improvement over that of the preceding year. We have gone through another very trying period of disturbance—political and monetary—and though we cannot but feel disappointed that our efforts have been to a large extent neutralised by the unexpected rise in the gold premium, still it is a matter for congratulation that the receipts have continually increased, and also their net value for the year. It might reasonably have been expected that the number of subscribers would have fallen off as a consequence of the depressed condition of commercial affairs in the Plate, but on the contrary, there has been during the year an increase of 606; for though there have been many withdrawals, the number of new subscribers has always exceeded those withdrawn, and upon this Mr. Krabbe (our local director) writes: "Considering the very bad position of a large part of business in Buenos Ayres, which has been to a great extent the result, in the first place, of over speculation in imports, and in the second place, of the very serious drought that the country has been experiencing for some seasons, the increase in subscribers must be considered extremely satisfactory, and shows that all through the crisis there is a natural increase, though small, in the total of business in Buenos Ayres—a healthy promise for the future. Of course this is to a certain extent the result of the *necessity* that the telephone is becoming; but we have other signs, such as tramway passengers, which also show an increase, and prove that it is resulting from increase of business in the city." The next matter I will go into is the receipts, which at par of exchange are £134,053, being an increase of £19,334 over the previous year. I indicated when I last addressed you that you might expect some increase in the working expenses. The working expenses at par of exchange are £60,874, as compared with £57,669 last year, and the percentage is 45·41 per cent. as against 49·99 per cent. in 1893, which testifies to the economical management in the Plate, where economies have been made in every possible direction; but we have had to increase the salaries of our employés, and the full effect of these additional charges has yet to be felt. In the construction department at Buenos Ayres the work has been unusually heavy during the past year, owing to the changes for new buildings, and this is likely to continue. We have had to make a number of lines for new subscribers, while changing and altering our wayleaves in various parts of the city. The municipality is advancing rapidly with the new avenue, which will necessitate a considerable outlay in getting across it with our lines. Our manager (Mr. Chappell) reports that the service continues good, and the complaints from subscribers have been very few. I sometimes think that shareholders hardly realise the difficulty there is in maintaining a good service during such revolutionary outbreaks as occurred last year, and the risks the staff of the company have to run when a central station becomes an important strategical position, as was the case with this company's business last year. The manager and staff deserve much credit for the energy and pluck they have displayed in the interests of the company. Now I come to the most serious matter, the loss on exchange, over which your directors have no control whatever. The loss on exchange is enormous, and for the year under review amounts to £54,124 17s. 9d., the highest figure yet reached. The fluctuations in the gold premium are so frequent and rapid that I do not wish to offer an opinion as to what its course may be in the future. So far as the past year is concerned, the loss on exchange follows up the larger part of the profit that otherwise would be available for distribution among our shareholders. The net profit, after paying the debenture interest and all other charges, is £9,782, and I repeat that it is most gratifying and encouraging—amid the turmoil and distress that has prevailed throughout the Argentine Republic, in common, mark you, with almost any other part of the world you can name—to be able to record this result. It is, indeed, full of hope for us, as mentioned in the report, we have allocated to certain accounts the sum of £4,270, of which the principal item is a sum of £3,000 transferred to depreciation and renewal fund. The net balance to be carried forward to next year will then stand at £6,417 17s. 4d. Upon this review of the situation there can, surely, be no doubt as to what should be the policy of the directors, and that is to husband the cash resources of the company and to strengthen its financial position as best they can. I feel certain that we can rely upon your

assistance in giving practical effect to this policy. I now move that the report and accounts submitted to the meeting be, and they are hereby, received and adopted.

Mr. Frank Jones seconded, and, in doing so, paid a high tribute to the staff in the Argentine for their conduct during the recent rebellion.

The report was then adopted, the retiring directors and auditors re-elected, and the meeting terminated after passing a special resolution of thanks to the managers and staff in the Argentine.

The Liverpool Overhead Railway Company.

The report of the directors states that the gross revenue receipts amount to £20,044 7s. 6d. The number of passengers carried since the opening of the railway being as follows:—

	From March 6th to June 30th, 1893.	Half-year ending December 31st, 1893.	Half-year ending June 30th, 1894.
First class	235,487	260,221	277,653
Second class ...	956,922	1,293,840	1,246,975
Workmen (special return tickets) ...	178,333	921,578	1,336,809
Total ...	1,370,742	2,475,639	2,861,437

During the past half-year 50,483 trains have been run, and 96 per cent. have been punctual. The northern extension was opened on April 30th, and the traffic at the Seaforth Sands Station has been very satisfactory. An arrangement has been made with the Liverpool Tramway and Omnibus Company to run omnibuses to this station, connecting it with the surrounding districts, and generally to act as feeders to the railway. Two new stations have been opened this month at points where experience has shown it to be desirable to provide further accommodation, viz., at Nelson and Huskisson Docks, and a third will shortly be opened at Langton Dock.

Revenue Account.

	£	s.	d.
The gross receipts from traffic amount to ...	19,658	13	11
Miscellaneous receipts	385	13	7
	£20,044	7	6
Less working expenses	14,947	5	6
	£5,097	2	0
From which deduct interest on debentures and calls paid in advance	2,639	7	7
	£2,457	14	5
Add balance brought forward from last year	2,598	7	1
Leaving available for dividend the sum of ...	£5,056	1	6

Out of this balance the directors recommend the declaration of dividends at the following rates (less income tax), payable on and after August 17th, viz.:—

	£	s.	d.	£	s.	d.
5 per cent. per annum on preference shares	2,170	13	8			
1 per cent. per annum on ordinary shares	1,875	0	0			
				4,045	13	8

leaving a balance of £1,010 7s. 10d. to be carried forward to next half-year.

The Hong Kong Electric Company, Limited.

The following is the report of the board of directors which was presented to the fifth ordinary yearly meeting of shareholders, held at the company's offices, 2, Queen's Road, on Monday, the 25th June:—"Your directors have the pleasure to submit the company's accounts for the year ending April 30th last, and they can again point to a steady progress in the company's business, the working account showing a credit balance of $6,310.94, which, transferred to profit and loss account, leaves it with a balance to the credit side of $7,248.47; while the amount overdrawn at the company's bankers has, during the year, been reduced from $12,267.17 to $6,339.97. There has been hardly that rapid extension of the company's operations for which your directors had hoped; still, there is a steady increase in the amount of house lighting, and the benefit from the installations now being fitted will soon be showing itself in the earnings. Notice has been given that shares on which the calls have not been paid will be dealt with according to the articles of association. The manager's report is, as usual, annexed, and shows the increase in the supply of the incandescent light, and the installations now in progress. There has been a smaller amount of installation work done during the year, also of outside work. The directors regret the death of Mr. J. S. Lapraik, which occurred during the year; the vacancy thus created has not been filled. Hon. C. P. Chater and Hon. J. J. Keswick retire by rotation, but being eligible, offer themselves for re-election. The accounts have been audited by Messrs. J. Ross Anton and J. C. Peter, in the place of Messrs. G. Stewart, absent from the colony, and H. Hunter, and they offer themselves for re-election."

The following is the manager's report:—"On April 30th, 1893, the number of lamps installed and supplied from the company's incandescent lighting plant amounted to 1,143, equivalent to 1,950 lamps of 8 candle-power, and in addition 40 lamps were in course of installation. I have now to report that, on April 30th, 1894, the number of lamps installed and connected to the company's mains amounted to about 1,400, equivalent to 2,240 lamps of 8 candle-power. In addition to the above, some 700 to 800 lamps were in course of installation, some of which have since been connected. Orders for installation of upwards of 60 lamps have since been received. The number of arc lamps supplied for street lighting remains the same as at the date of the last report. The plant and machinery have been maintained in good working order."

The Waterloo and City Railway Company.

The first half-yearly general meeting of the shareholders of this company was held at Waterloo Station yesterday afternoon, under the presidency of Mr. Wyndham S. Porter (chairman of the company). The business was purely formal. The chairman proposed the adoption of the report, which was published in the Electrical Review for July 27th, and which he considered was very satisfactory. This was unanimously agreed to. A resolution adopting the provisions of the Forged Transfers Acts of 1891 and 1892, declaring the indefeasibility of the company's share certificates without any charge being made to the registered holders thereof was also carried, and the meeting then terminated.

The Gülcher (New) Electric Light and Power Company, Limited (In Liquidation).—Notice is given that an extraordinary general meeting of the above-named company will be held at the offices of Messrs. C. F. Kemp, Ford & Co., 73, Lombard Street, in the City of London, on Thursday, August 16th, 1894, at 11 o'clock in the forenoon, under the provisions of Section 161 of the Companies' Act, 1862, when the subjoined resolution, which was duly passed at the extraordinary general meeting of the company held on August 1st, 1894, will be submitted for confirmation as a special resolution:—Resolved: "That Mr. Charles Fitch Kemp, the liquidator, be authorised to enter into an agreement with Easton, Anderson and Goolden, Limited, for the sale to that company of this company's plant, machinery, and stock-in-trade at the price of £12,500, payable as to £5,700, part thereof, in cash, and as to £6,800, the balance thereof, in 680 shares of £10 each, fully paid up in Easton, Anderson & Goolden, Limited."

Official Announcements re Limited Companies.—Notice is given in the *London Gazette* to the effect that the undermentioned companies have been struck off the register, and are accordingly dissolved:—

Automatic Electrical Corporation, Limited.
" Electric Supply Company, Limited.
British Electric Propulsion and Traction Company, Limited.
Electrical Works Construction and Maintenance Company, Limited.
Electro-Galvanic Machine Company, Limited.
Gold Amalgamator Syndicate, Limited.
Medical and Scientific Apparatus Company, Limited.
New Electro-Amalgamator Company, Limited.
Portland Electric Light Company, Limited.
Thompson's Electrical Fitting and Screw Cutting Company, Ltd.
Wolverhampton Electric Light and Power Company, Limited.

And at the end of three months from August 3rd, the name of the following will, unless cause is shown to the contrary, be struck off the register, and the company accordingly dissolved:—

St. Luke, Chelsea, Electric Lighting Company, Limited.

Oswestry Electric Lighting and Power Company.—Arrangements have been made by the company to guarantee a minimum dividend of 3 per cent. per annum upon the share capital up to £4,000, such guarantee to be in force for a period of three years from the date of the first supply of electricity to the town by the company, and not to apply to the shares held by the present chairman.

TRAFFIC RECEIPTS.

The City and South London Railway Company. The receipts for the week ending August 5th, 1894, amounted to £848; week ending August 6th, 1893, £804; increase, £44: total receipts for half-year, 1894, £4,306; corresponding period, 1893, £4,237; increase, £69.

The Direct Spanish Telegraph Company, Limited. The estimated receipts for the month of July, 1894, amounted to £1,400, against £1,656 in the corresponding period of last year.

The Great Northern Telegraph Company. The traffic receipts in July, 1894, were £25,600; January 1st to July 31st, 1894, £155,400; corresponding months, 1893, £156,800; corresponding months, 1892, £152,000.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending August 3rd, after deducting 17 per cent. of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited, were £2,335.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1891.	1892.	1893.	Closing Quotation, August 1st.	Closing Quotation, August 8th.	Business done during week ended August 8th, 1894. Highest.	Lowest.
184,500£	African Direct Teleg., Ltd., 4 % Deb.	100	...	...	...	101 —104	101 —104	...	...
1,134,640£	Anglo-American Teleg., Ltd.	Stock	£2 12s.	£2 15s.	£2 11s.	37 — 40 xd	37 — 40 xd	...	...
2,932,680£	Do. do. 6 % Pref.	Stock	£5 5s	£5 10s.	£5 2s.	70 — 72 xd	70 — 72 xd	71¾	70½
2,932,680£	Do. do. Defd.	Stock	...	...	...	6½— 7	6½— 6¾	6⅝	...
130,000	Brazilian Submarine Teleg., Ltd.	10	8 % §	6½% §	6½% §	12 — 12½	12¼— 12⅜	12⅜	12¼
18,700£	Do. do. 5 % Bonds	100	...	...	...	... — ... xd	... — ... xd	...	...
75,000£	Do. do. 5 %, repayable June 1906	100	...	...	...	107 —111	107 —111	...	...
44,000	Chili Telep., Ltd., Nos. 1 to 40,000	5	... §	10%‖ §	... §	1 — 2	1 — 2	...	...
10,000,000$	Commercial Cable Co.	$100	7 %	7 %	7 %	139 —143	139 —143	...	...
224,850	Consolidated Telep. Const. and Main., Ltd.	10/-	3½% §	2 % §	2 % §	⅛ — ¼	⅛ — ¼	...	...
16,000	Cuba Teleg., Ltd.	10	8 %	8 %	8 %	12½— 13½	12½— 12½	...	...
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	19½— 20½	19½— 20½	...	...
12,931	Direct Spanish Teleg., Ltd., £4 paid	5	4½%	4 %	4 %	4 — 4½	4 — 4½	...	...
6,000	Do. do. 10 % Pref.	5	10 %	10 %	10 %	9¼— 9⅝	9¼— 9⅜	...	...
30,000£	Do. do. 4½ % Debs. of £50, Nos. 1 to 1,600	...	...	...	...	103 —106%	103 —106%	...	...
60,710	Direct United States Cable, Ltd., 1877	20	3½% §	3½% §	...	8 — 9 xd	8 — 9 xd	8⅞	8⅝
400,000	Eastern Teleg., Ltd., Nos. 1 to 400,000	10	6½% §	6½% §	...	15½— 15⅞	15½— 15⅞	15⅞	15½
70,000	Do. 6 % Pref.	10	6 % §	6 % §	...	16 — 16½xd	16¼— 16¼xd	16½	16⅜
105,900£	Do. 5 % Debs., repay. August, 1899	100	...	...	...	105 —109	105 —109 xd	...	...
1,294,100£	Do. 4 % Mort. Deb.	Stock	...	...	...	116 —119	116 —119	...	...
250,000	Eastern Extension, Australasia and China Teleg., Ltd. ...	10	7 %	7 %	7 %	15⅝— 15⅞	15⅝— 15⅞	15⅞	15⅝
62,700£	Do. 5 % (Aus. Gov. Sub.), Deb., 1900, red. ann. drgs. reg. 1 to 1,049, 3,976 to 4,326	100	...	...	...	103 —106	103 —106	...	...
222,800£	Do. do. Bearer, 1,050—3,975 and 4,327—6,400	100	...	...	...	103 —106	103 —106	104	...
320,000£	Do. 4 % Deb. Stock	Stock	...	...	...	114 —117 xd	114 —117 xd	...	...
95,100£	Eastern and South African Teleg., Ltd., 5 % Mort. Deb. 1900 redeem. ann. drgs., Reg. Nos. 1 to 2,343	100	...	...	...	103 —106	103 —106	...	...
129,100£	Do. do. do. to bearer, 2,344 to 5,500	...	...	...	...	103 —106	103 —106	...	...
300,000£	Do. 4 % Mort. Debs. Nos. 1 to 2,016, red. 1909	100	...	...	...	103 —106 xd	103 —106 xd	...	...
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1 to 8,000	25	...	...	...	107 —110%	107 —110%	...	...
180,227	Globe Telegraph and Trust, Ltd.	10	5½% §	4½% §	4⅝% §	8⅜— 8⅝	8⅜— 8⅝	8 1/16	8 5/16
180,042	Do. do. 6 % Pref.	10	6 % §	6 % §	6 % §	15⅜— 15⅝	15⅝— 15⅞	15¼	15⅜
150,000	Great Northern Teleg. Company of Copenhagen	10	8⅜% §	8⅜% §	8⅜% §	20 — 20½	20 — 20½	...	...
200,000£	Do. do. do. 5 % Debs.	100	...	...	...	105 —108	105 —108	...	...
17,000	Indo-European Teleg., Ltd.	25	10 %	10 %	10 %	44 — 46	44 — 46	...	...
37,548	London Platino-Brazilian Teleg., Ltd.	10	...	...	...	5 — 7	5 — 7	...	...
100,000£	Do. do. 6 % Debs.	100	...	...	...	108 —110	108 —111	110½	110
15,000	Monte Video Teleph. Co., Ord., 1 to 15,000	5	...	...	...	⅛— 1⅛	⅛— 1⅛	...	...
28,000	Do. do. 6 % Pref., 1 to 28,000	5	...	...	...	1 — 2	1 — 2	...	...
484,597	National Teleph., Ltd., 1 to 438,984	5	6 % §	5 % §	...	4⅜— 5	4⅜— 5	4 15/16	4⅜
15,000	Do. 6 % Cum. 1st Pref.	10	...	...	...	14 — 15	14 — 15	14 15/16	...
15,000	Do. 6 % Cum. 2nd Pref.	10	...	...	...	13½— 14½	13½— 14½	...	...
119,234	Do. 5 % Non-cum. 3rd Pref., 1 to 90,950	5	...	...	...	5⅜— 5⅝	5⅜— 5⅝	5½	...
925,017£	Do. 4½ % Deb. Stock Prov. Certs. ...	...	...	...	...	109 —112	109 —112	...	...
48,800	New Teleph., Ltd., 25,901 to 74,700; £4 paid	10	...	...	...	... — ...	... — ...	...	...
171,504	Oriental Teleph. & Elec., Ltd., Nos. 1 to 171,504, fully paid	1	...	...	...	½— ⅝	½— ⅝	½	...
100,000£	Pacific and European Tel., Ltd., 4 % Guar. Debs, 1 to 1,000	100	...	...	...	102 —105	102 —105	...	...
11,839	Reuter's Ltd.	8	5 %	5 %	...	4½— 5½	3 — 5	...	...
3,381	Submarine Cables Trust	Cert.	...	...	...	108 —113	108 —113	...	...
58,000	United River Plate Telaph., Ltd.	5	...	...	...	1 — 2	1 — 2	...	...
146,370£	Do. do. 5 % Debs.	Stock	...	...	...	85 — 95	85 — 95	...	...
15,609	West African Teleg., Ltd., 7,501 to 23,109	10	4 %	..	...	3 — 5	3 — 5	...	...
249,900£	Do. do. do. 5 % Debs.	100	...	...	...	102 —105	102 —105	103½	...
30,000	West Coast of America Teleg., Ltd.	10	...	...	...	2½— 3	2½— 3	...	...
150,000£	Do. do. do. 8 % Debs., repay. 1902	100	...	...	...	96 —101	96 —101	...	...
64,242	Western and Brazilian Teleg., Ltd.	15	4 %	2½%	5 %	6¾— 7¼	6¾— 7¼	7	...
33,129	Do. do. do. 5 % Cum. Pref. ...	7½	...	...	...	5⅞— 6¼	5¾— 6¼	...	...
33,129	Do. do. do. 5 % Def.	7½	3 %	...	...	1¾— 2¼	1¾— 2¼	1⅞	...
178,200£	Do. do. do. 6 % Debs. "A," 1910 ...	100	...	...	...	105 —108xd	105 —108 xd	...	...
222,700£	Do. 6 % Mort. Debs., series "B," red. Feb. 1910	100	...	...	...	105 —108xd	105 —108 xd	...	...
88,321	West India and Panama Teleg., Ltd.	10	¼%	¼%	⅜%	1 — 1¼	1 — 1¼	1⅛	1 1/16
34,563	Do. do. do. 6 % 1st Pref. ...	10	...	...	...	10 — 10½	10 — 10⅛	10 7/16	10 5/16
4,669	Do. do. do. 6 % 2nd Pref. ...	10	...	...	...	9 — 10	9 — 10	...	...
80,000£	Do. do. 5 % Debs. (1917) No. 1 to 1,000	100	...	...	...	107 —110	107 —110	...	...
$1,214,000	Western Union of U. S. Teleg., 7 % 1st Mort. Bonds ...	$1000	...	...	...	115 —120	115 —120	...	...
169,000£	Do. do. 6 % Ster. Bonds.	100	...	...	...	100 —104	100 —104	...	...

ELECTRICITY SUPPLY COMPANIES.

20,510	Charing Cross and Strand Electy. Supply, 1 to 6, 215 to 718, and 10,001 to 30,000	5	...	5 %	4½%	4½— 5½	4½— 5½	...	...
40,000	City of London Elec. Lightg. Co., Ltd., Ord. 40,001—80,000	10	...	...	...	12½— 13½	12½— 13½	...	...
40,000	Do. do. 6 % Cum. Pref., 1 to 40,000	10	...	6 %	6 %	14 — 14½	14 — 14½	14⅜	14¼
100,000	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	...	...	...	128 —130	128 —131	...	...
45,000	†Liverpool Electric Supply, £4 10s. paid	5	4½%	5 %	5 %	6½— 6⅝	6⅜— 6½	...	...
49,900	*Metropolitan Electric Supply, Ltd., 6,101 to 50,000 ...	10	1 %	2 %	2½%	8½— 9	8¼— 8¾	...	...
100,000£	Do. 5% Deb., 1 to 10,000 in bonds of £10, £20, £40	...	...	...	...	... — ...	... — ...	...	...
6,452	Notting Hill Electric Lightg. Co., Ltd.	10	...	...	...	4½— 5½	4½— 5½	...	...
19,980	St. James's & Pall Mall Elec. Light Co., Ltd., Ord., 101-18,780	5	8½%	7½%	4½%	7 — 7½xd	7 — 7½xd	...	...
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	8¼— 8⅜	8½— 9 xd	...	...
59,900	*Westminster Electric Supply Corp., Ord., 101 to 60,000 ...	5	...	3½%	4 %	6 — 6½xd	6 — 6½xd	...	...

* Subject to Founder's Shares. † Quotations on Liverpool Stock Exchange.

‡ Unless otherwise stated all shares are fully paid. ‖ Dividends paid in deferred share warrants, profits being used as capital.

Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL, COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1891.	1892.	1893.	Closing Quotation, August 1st.	Closing Quotation, August 8th.	Business done during week ended August 8th, 1894. Highest.	Lowest.
90,000	Brush Elecl. Enging. Co., Ord., 1 to 90,000...	3	...	6 % §	6 % §	2⅞— 3	2⅞— 3	2 15/16	2 13/16
90,000	Do. do. Non-cum. 6 % Pref., 1 to 90,000	2	...	6 % §	6 % §	2¼— 2½	2¼— 2½	2 7/16	2¼
125,000/	Do. do. 4½ % Deb.	Stock	...	...	...	110 —113	110 —113	...	...
630,000/	City and South London Railway	Stock	...	⅝%	⅝%	36 — 38	36 — 38	36½	...
20,000	Crompton & Co., Ltd., 7 % Cum. Pref. Shares, 1 to 20,000	5	7 % §	7 % §	7 % §	2½— 3	2 — 2½	...	...
50,000/	Do. do. 5 % 1st Mort. Debs., 1—400 of £100, and "A" 1—200 of £50 each	...	...	...	...	95 —100	95 —100	...	...
120,000	Electric Construction, Ltd., 1 to 120,000	2	...	...	...	¼— ⅜	¼— ⅜	...	...
12,845	Do. do. 7 % Cum. Pref., 1 to 12,845 ...	2	...	...	...	1¼— 1⅜	1¼— 1⅜	...	...
100,000	Elmore's French Patent Cop. Deposg., Ltd, 1 to 66,750 ...	2	*nil*	*nil*	*nil*	¼— ⅜	¼— ⅜	...	...
91,195	Elmore's Patent Cop. Deposg., Ltd., 1 to 70,000	2	*nil* ¶	*nil*	*nil*	1 — 1¼	1 — 1¼	...	...
67,385	Elmore's Wire Mfg., Ltd., 1 to 67,385, issued at 1 pm. ...	2	*nil*	*nil*	*nil*	¾— 1	¾— 1	...	...
20,000	Fowler-Waring Cables, Nos. 301 to 20,300	5	*nil* §	*nil* §	*nil* §	½— 1¼	½— 1¼	...	...
9,600/	Greenwood & Batley, Ltd., 7 % Cum. Pref., 1 to 9,600 ...	10	7 %	...	...	6 — 6½	6½— 7½	...	...
6,837	Henley's (W. T.) Telegraph Works, Ltd., Ord.	10	5 %	5 %	5 %	7 — 8	7 — 8	...	...
50,000	India-Rubber, Gutta Percha and Teleg. Works, Ltd. ...	10	12½%	12½%	12½%	23 — 24	23 — 24	23 11/16	23⅜
200,000	Do. do. do. 4½ % Deb., 1896	100	...	...	...	103 —105	103 —105	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	...	...	1 %	8½ — 8¾	8 3/16— 8 5/16	...	...
6,295	† Do. do. Pref., £8 paid	10	...	...	...	12⅞— 13⅛	12⅞— 13⅛	...	...
78,949	Swan United Electric Light, Ltd., £3½ paid	5	11 % §	10 % §	7½%§	... — ...	... — ...	...	...
37,350	Telegraph Constn. and Maintce., Ltd.	12	20 %	15 %	20 %	40 — 42 xd	40 — 42 xd	41½	...
150,000/	Do. do. do. 5 % Bonds, red. 1894	100	...	...	...	102 —105	102—105	...	...
54,000	Waterloo and City Railway, Nos. 1 to 54,000, £2 paid ...	10	...	...	...	2 — 2¼	2 — 2¼	...	...

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ Last dividend paid was 50% for 1890.

Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.

Crompton & Co.—The dividends paid on the ordinary shares (which have not a Stock Exchange quotation), are as follows: 1892—0%§; 1891—7%§; 1890—8%§.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Birmingham Electric Supply Company, Ordinary of £5 (fully paid), 5¼—5⅜.

Electric Construction Corporation, 6 % Debentures, 87—92.

Electric and General Investment, shares of £5 (£1 paid), 1⅞—2¼.

Electricity Supply Corporation, Ordinary of £5, 5—5¼.

House-to-House Company (£5 paid), 1—1½.

Do. do. 7 % Preference, of £5, 5¼—5½.

Do. do. 6 % Debentures of £100, 101—103.

Kensington and Knightsbridge Electric Lighting Company, Limited, Ordinary Shares £5 (fully paid) 4⅜—5¼; 1st Preference Cumulative 6 %, £5 (fully paid), 6½—6⅝.

Liverpool Electric Supply, £5 (fully paid), 6½—6¾.

Do. do. £3 10s. paid, 4⅛—4⅜.

London Electric Supply Corporation, £5 Ordinary, ⅞—1⅛.

Queen Anne's Mansions Lighting and Heating Company, 6 % £100 Debentures, 101—103.

Yorkshire House-to-House Electricity Company, £5 Ordinary Shares (£4 10s. paid), 4½—4⅝.

Bank rate of discount, 2 per cent. (February 22nd, 1894).

REVIEWS.

Journal of the Institution of Electrical Engineers. Nos. 112 and 113. London: E. & F. N. Spon, 125, Strand.

The general contents of these numbers are as follows:—No. 112, "A Universal Shunt-Box for Galvanometers"; Supplementary remarks by Professor Ayrton; "The Best Resistance for the Receiving Instrument on a Leaky Telegraph Line" (discussion); "Transparent Conducting Screens for Electric and other Apparatus," by W. E. Ayrton and T. Mather; "Cost of Electric Energy," by R. E. Crompton. No. 113, "Cost of Electric Energy," by R. E. Crompton (discussion); "Notes on Electric Tramways in the United States and Canada," by H. D. Wilkinson.

The London Matriculation Directory. No. XVI. June, 1894.

This is the calendar of the University Correspondence College, and gives particulars of the staff of the same and full details of all matters usual in calendars of the kind. At the end of the book are sets of the questions set at the various examinations, and also a valuable set of answers to the same by various well-qualified University men.

The Practical Management of Dynamos and Motors. By Crocker and Wheeler. London: E. & F. N. Spon.

This little work relates almost entirely and exclusively to the Crocker-Wheeler dynamos and motors, written for the information of dynamo and motor users. Part I. deals with the details of Crocker-Wheeler machines, and is only descriptive. Part II. deals with the examination and testing of machines and is exceedingly elementary, quite within the capacity of an intelligent dynamo-tender. Part III. the "Localisation and Remedy of Troubles in dynamos," is eminently trans-Atlantic; of the nine troubles enumerated only two, and those the last two, "Dynamo fails to Generate," "Motor fails to Start," are of any importance to dynamo users.

The other seven are not troubles at all but effects of bad design and bad construction. Their remedy is not tinkering or patching but better design and construction. Any dynamo or motor developing one or more of these troubles may be considered as worthless.

The dynamos illustrated as subject to these troubles have all the known appearances of bad design. Users of them will find this work handy in suggesting means to keep them up to their work.

Workmen called upon to attend to motors and dynamos will find the book of much help, especially in the case of Crocker-Wheeler machines. It is profusely illustrated.

Electrical Apparatus for Amateurs. Edited by F. Chilton-Young. Ward, Lock & Bowden, Limited, Warwick House, Salisbury Square, London.

This small work is divided into five parts, relating to telephones, the electric light, magneto-electric machines, cylinder electrical machines, and induction coils. Each part is written by a different writer, and the whole is edited by the author of that excellent compilation, "Every Man his own Mechanic." The book is a capital one for amateurs, the instructions for the manufacture of the various pieces of apparatus being mostly very precise and clear, small difficulties which are likely to arise in the course of manufacture being pointed out, and not glossed over, as is so often the case in books of the kind. The writers are not, however, always as precise as advisable; for example, in describing how to set up a Leclanché battery, the connection

on to the carbon plate is stated as being made by a brass clamp, nothing being said about paraffining the upper part of the plate, without which perpetual troubles are almost certain to arise. Again, with reference to the construction of an induction coil, the secondary is to be wound on in the same way as a reel of cotton or thread. Now, anyone who has tried to do this must know perfectly well that it is impossible for an amateur to do this. Nothing is mentioned about insulating the various layers from each other, a very necessary arrangement when a condenser is used as directed. However, with all its imperfections, the book is a useful one, and one to be recommended.

"*Electricity one Hundred Years ago and To-day.*" By Edwin J. Houston. Published by the W. J. Johnston Company, Limited, New York. Price one dollar.

In view of the almost hopeless tangle into which electrical facts have fallen during the past century it was with pleasure that we looked upon the title of a book which might restore the results of ubiquitous invention to a concise historical sequence and definite plan. "Electricity, One Hundred Years ago and To-day," suggested an indexed and formulated selection of useful technical developments, but we regret to find in this little book only a loose conspectus of stray "snippings," compiled *sans gêne* and *sans génie*. The hundred years is strained back to the days of Thales of Miletus, of famous text-book memory; to King Solomon, the arch-ghost of wisdom; to glorious Francis Bacon, who was born we believe in 1561; and to Priestley, Gilbert, and Von Kleist; so that by the time of our wanderings through one-third of the book history has only progressed to the period of the Scottish Rebellion. At this place the patient reader has hopes that the hundred years will soon commence, but he is suddenly spirited away across a century to the scintillations and dreams of Tesla, and scarcely has he recovered from the effect of this erratic flight than he finds himself drawn again to earth by the early magnets of Prof. Henry. Hertz follows—perhaps because his name also has an initial aspirate—and then Franklin and Snow Harris. The middle portion of this book is devoted to the question of lightning rods, with an account of the discussions which arose about them in the two "camps" of 1888; by this time, however, we have learned to swing with the pendulum and to keep "in step" with chronological alternations, so that it is really not very startling to hark back to the frogs and inventions of Galvani. At this point, too, there is a marked improvement in the general method and arrangement, the author sticks to his "hundred years," and finally hits upon the happy idea of stringing his materials in something like historical order; but the reader is still perplexed by the extracts from other books which are coupled "in parallel" with the text, and being far more copious than the actual subject-matter, keep him in constant doubt as to the drift and purpose of the author. It is difficult, after considering the hap-hazard and embarrassed style of the book itself, to give full value to the remarks contained in its appendix, where the author criticises to the doctrines and inductive methods propounded by Francis Bacon for facilitating and formulating scientific research. This allusion to Bacon is simply abstracted from "The Pioneers of Science," in the language of Prof. Oliver Lodge. In whatever light we regard the life and personality of this great Lord Verulam, it is impossible to dispel its picturesqueness; he is the King Arthur of that strange and troubled period of English history when science and literature had to fight their way against their powerful foes—state-craft and superstition. Dr. Lodge thinks that the influence of Bacon has been exaggerated, and that many of the methods which Bacon laid down are not those which experience has found serviceable, nor such as a scientific man would have thought of devising; in short, that philosophers are born, like common poets and criminals; and that latent intuition is sufficient without the aid of rules. There is at least one invention of present-day interest which may be traced as the outcome of Bacon's writings, we instance the suggestion of a system of code signs, such as was ultimately perfected by Morse; as it was only recently ascribed to Lord Verulam by a member of the Baconian Society, we take this opportunity of placing it on record, and commending it to those who are sufficiently condescending to give the old philosopher the title "Scientific Amateur."

There is an approach to originality in Mr. Houston's history where he ventures to call in question the claims of Davy as the inventor of the carbon voltaic arc, but even here we cannot accord with his conclusions; for while it is clear and generally admitted that the mere phenomenon of the arc was a previous discovery of someone's, yet we can find no evidence to justify the suggestion that the use of *carbon* was not due to Davy. It was this discovery which made the arc lamp practicable, and to Davy properly belongs the honour of its parentage.

Ministero delle poste e dei Telegrafi. Relazione Statistica intorno ai Servizi postale e Telegrafico per e' Esercizio 1892-3, *ed al Servizio delle Casse postali di Risgarmio per l'Anno*, 1892.* Roma: Bertero, 1894.

The departments concerned prove to have yielded a net income of 12,720,333.15 lire.

In the report on the telegraphs we find that the total number of accidents arising from fracture of the supports was 60; from the rupture of the wires 693; from the breakage of the insulators 464; from contacts and losses of currents 3,501; from lightning 251. The accidents happening to lines conducted along railways and along common roads have been enumerated separately, and it appears that on the latter class of lines they have been largely in excess. Accidents from lightning have been more frequent to lines conducted along common roads than to such as follow railways in the proportion of 141 to 110. Up to June 30th the total number of telegraphic stations was 4,936, being an increase of 140 since June 30th, 1892. Of these, 2,051 stations belong to the railways and tramways, including 482 which are not available for the public. Of the apparatus in use, there are 4,508 simple Morse instruments and four duplex. The Hughes instruments are 117 simple and 10 duplex. Of Wheatstone instruments there are 12 complete, five merely for transformation and 68 for receiving only. Of Baudot instruments there are in use five duplex and four quadruplex. It is to be remarked that in the year there has been no increase in the number of Wheatstone and Baudot instruments, nor in the duplex apparatus on the Morse or the Hughes systems.

The number of private inland telegrams forwarded from Government offices has been 6,875,719, being an increase as compared with the previous year of 100,029.

The private inland telegrams sent from the railway offices have been 720,415. The total of dispatches sent to foreign countries have been 814,694. Those sent from one foreign country to another have been 129,623.

The classification of the dispatches shows that 38·10 per cent. were on affairs of commerce and of the stock exchange, 3·21 were political, 29·15 on family matters, 27·16 miscellaneous, whilst 0·36 were written in cypher.

There has been no alteration in the tariff during the year.

No innovation has been introduced during the year 1892-1893 in the meteorological service, as far as concerns the telegraphic transmission of the meteorological bulletin; and there has been no alteration in the seismic service.

The use of public telephone lines shows a decrease of from 179,677·17 to 169,364·25, as compared with the previous season. On the other hand, the messages on private lines have increased from 27,085·45 to 30,052·85. The number of urban nets has decreased from 73 to 53, due to the amalgamation of the nets in contiguous districts.

THE PACIFIC CABLE OUTLAY AND EARNINGS.

One of the most important questions considered by the recent Intercolonial Conference at Ottawa, Canada, was that of submarine cable communication between the various colonies. Several British colonies took part in the conference, and those of Canada, Australia and New Zealand were ready to support the plan of laying a cable, across the Pacific, whose ends should be landed within British territory.

* "Ministry of Posts and Telegraphs. Statistical report on the postal and telegraphic services for the season 1892-93, and on the service of the postal savings' bank for 1892."

Among those watching and assisting more or less directly in the work of the conference was Mr. Alexander Siemens, of Siemens Bros. & Co., of London. Both to the delegates and to the press, Mr. Siemens furnished some most valuable data, and subjoined is a *précis* of his statements on the subject.

The cable could be laid, he observed; the only question was as to what it would cost. His calculation was, that a cable of the best description could be laid for an outlay of £2,000,000, and he backed his views by a series of very carefully prepared calculations. All the sums given are absolutely outside figures, he said, and in addition to the weight attaching to them from his own experience he has had them checked off by prominent cable experts, so that the actual expenditure could hardly fall outside of them, and is far more likely to be less. The first calculation which he presented was that of the capital account. The debit side of that was: Capital to be raised under Government guarantee at 3 per cent., £2,000,000.

On the credit side appears:—

7,340 nautical miles cable	£1,720,000
Steamers	200,000
Buildings, &c.	30,000
Working capital	50,000
	£2,000,000

Further details are given by Mr. Siemens of these estimates. The route upon which he bases his calculations consists of four sections, Ahaipara Bay (N.Z.) to Suva (Fiji Islands); Suva to Canton, or Mary (Phœnix Islands); Canton to Neckar Island, and Neckar Island to Vancouver, B.C., the total length being, as already stated, 7,340 nautical miles. The item next after that of the actual cost of the cable is that of £200,000 for steamers. Two of these, of about 1,800 tons each, would be needed, to cost £100,000 each. The items of £30,000 for buildings and instruments is made up as follows:—

3 cable houses, £300	£900
3 sets fittings for ditto, £200	600
12 large houses at £1,000	£12,000
12 outfits for same at £500	6,000
14 sets recorders complete at £400	5,600
5 sets testing instruments, with extra spares, at £240	1,200
Transport and erection	3,700
Total	£30,000

This, then, will be the initial cost of the cable. It will be seen that £50,000 is left for the working expenses, and the question arises as to what these expenses will be. The yearly working expenses Mr. Siemens divides as follows:—

(*a*) General management	£5,000
(*b*) Staff and officers' expenses at stations	24,000
(*c*) Repair and maintenance of cables	90,000
Total annual outlay	£119,000

The first item in this explains itself. Details for the second were given by Mr. Siemens as follows:—

Vancouver, B.C.	Per annum.
1 superintendent	£400
4 clerks at £200	800
2 messengers at £50	100
4 boys at £30	120
Taxes, ground rent, renewals and repairs	200
Stationery, insurance, advertising	200
Sundries unforeseen	200
	£2,000
Neckar and Canton Islands (each):—	
1 superintendent	£600
8 clerks at £500	4,000
3 messengers at £100	300
Rations, £1 per week per head	600
Sundries unforeseen	500
2 × £6,000	£12,000
Suva (Fiji) and Ahaipara (N.Z.) each.	
1 superintendent	£500
8 clerks at £400	3,200
3 messengers at £80	240
Rations, £1 per week per head	600
Sundries unforeseen	460
2 × £5,000 =	£10,000

Total annual cost of staff and office expenses, £24,000.

The larger salaries given at Neckar and Canton Islands are caused by the nature of the places, which are mere rocks, and very undesirable habitations.

The third item, that of repair and maintenance of the cables, is the most difficult to estimate, and the expenditure falls into two parts, the fixed and the variable. The fixed part consists in the maintaining in efficient order of the two repairing steamers, which can be done for £100 per month, per steamer, and in wages, victualling, and other expenses, which would be covered by an allowance of £20 per day per steamer. These vessels would have to be kept ever ready to go out to attend to breaks, but would not be likely on an average to be at sea more than two months in the year, while it is not likely that more than 200 miles of cable would be used up in repairs in a year. It is very possible that far less would be needed, for good ocean cables do not deteriorate and are practically good for ever, while at the rate of repair calculated upon, the entire cable would be renewed in 37 years; so that here again a very liberal calculation has been made. This repair rate would be about £12 per nautical mile per year, while it is usual to calculate £6 per nautical mile, to cover repairs, and one Atlantic company keeps 6,000 miles of cable in efficient working order for about £4 per nautical mile. The full calculation of annual repairs and maintenance made by Mr. Siemens is:

(*a*) Fixed expenses—	
Two steamers, repair of hull and machinery, at £1,200 each	£2,400
Wages of crew, victualling, &c., 2 × 365 days at £20 per day	14,600
(*b*) Variable expenses—	
Average of two months at sea for each steamer, ropes and other stores, extra pay, &c., at £125 per day	15,000
100 nautical miles of cable at £200 per nautical mile (for shallower water)	20,000
100 nautical miles of cable at £350 per nautical mile (for deeper water)	35,000
Sundries	3,000
Total	£90,000

One of the steamers would be stationed at Vancouver, B. C., and the other at Suva, Fiji Islands.

This, then, covers the expense of the work, both the initial outlay and the annual expense and maintenance account. The crucial point comes: Will the cable pay? Mr. Siemens holds that it should. It appears by Sir John Pender's statement that the existing Australian traffic is worth £209,628 net for 1,306,716 words, or 3s. 1½d. per word. It is only fair to assume that the new line would get half of this traffic, and so realise at once, say £104,000 per annum. Now, in the first year of the new cable the expenses for repairs would likely not be very great, and so the first year's business of the Canadian-Australian line, on this basis of calculation, would pay working expenses and leave an ample margin. But the cable is being laid with an eye to the future as well as the present, Mr. Siemens observed, and as the trade between America and Australasia increases, so will the cable communication; the cable will both promote

The Atlantic Cables.

No. of cables.	Company.	Laid.	Between.	Length in miles.
		1858	Ireland and Newfoundland	Abandoned.
		1865	Ireland and Newfoundland	Abandoned.
		1866	Ireland and Newfoundland	Abandoned.
5	Anglo-American Telegraph Co.	1873	" "	1,885
		1874	" "	1,846
		1880	" "	1,890
		1894	" "	1,850
		1869	France and St. Pierre Miquelon	2,685
1	Direct United States Cable Co.	1874-5	Ireland and Nova Scotia	2,565
1	Paris and New York Cable Co.	1879	France and St. Pierre Miquelon	2,242
2	American Cable Company	1881	Land's End (Eng.) and Nova Scotia	2,531
		1882	Land's End (Eng.) and Nova Scotia	2,576
3	Commercial Cable Company	1884	Ireland and Nova Scotia	2,350
		1884	Ireland and Nova Scotia	2,388
		1894	Ireland and Nova Scotia	2,201

more traffic and benefit by it. From a calculation made in 1887 by Mr. Henniker Heaton, it appears that the 26 submarine cable companies then in existence had spent on an average £350 for each nautical mile of their cables, and derived an income of £31 15s. per nautical mile; with many of the companies the capital outlay was far less, and the income far greater. Now, at the very liberal calculations made and already given, the proposed Pacific cable would cost £273 per mile; and if it met with average success, and earned, say, £30 per mile, the annual income would be £220,000. For the first two or three years this figure cannot be expected to be reached, but it is under the average of the earnings of all submarine companies of 1887, and since then ocean telegraphic communication has rapidly increased. One Atlantic company has in the past three years earned an average of £50 per mile per year.

If the new Pacific cable gets its share and charges 2s. per word, 2,200,000 words per year would be enough to realise this income, and the cable, which would be put in for £2,000,000, could send 15 words per minute on the recorder, or 7,000,000 words per year, ample provision being made in the estimates for a staff large enough to afford relays sufficient to do this. And by introducing duplex working, the speed could be doubled. Granting then an income of £220,000, the revenue account would stand as follows:—

Debit side:—	£
General management	5,000
Staff, &c.	24,000
Repairs and renewals	90,000
To profit and loss account	101,000
	£220,000

Credit side:—	£
Earnings	220,000

The profit and loss account would stand thus:—

Debit side:—	£
Three per cent. interest on capital	60,000
Two per cent. amortisation of capital	40,000
Carried forward	1,000
	£101,000

Credit side:—	£
From revenue account	101,000

On this calculation Mr. Siemens held that the line is feasible, both practically and commercially.—New York *Electrical Engineer*.

PROCEEDINGS OF SOCIETIES.

The Royal Society.

The Rotation of the Electric Arc. By Alexander Pelham Trotter, B.A. Communicated by Silvanus P. Thompson, F.R.S. Received by the Royal Society June 12th, 1894.

In the course of experiments made with the view of realising, as a practical standard of light, the method of using one square millimetre or other definite area of the crater of the positive carbon of an electric arc,* the author has found that the effective luminosity is not as theory would predict,† either constant or uniform. By the use of a double Rumford photometer, giving alternating fields, as in a Vernon Harcourt photometer, his attention was called to a bright spot at or near the middle of the crater. The use of rotating sectors accidentally revealed that a periodic phenomenon accompanied the appearance of this bright spot, and although it is more marked with a short humming arc, the author believes that it is always present.

An image of the crater was thrown on a screen by a photographic lens, and a disc having 60 arms and 60 openings of 3°, and rotating at from 100 to 400 revolutions per minute, was placed near the screen. Curious stroboscopic images were observed, indicating a continually varying periodicity seldom higher than 450 per second, most frequently about 100, difficult to distinguish below 50 per second, and becoming with a long arc a mere flicker. The period seemed to correspond with the musical hum of the arc, which generally breaks into a hiss at a note a little beyond 450 per second. The hum is audible in a telephone in the circuit, or in shunt to it. The current was taken from the mains of the Kensington and Knightsbridge Electric Light Company, often late at night, after all the dynamos had been shut down. The carbons were, of course, not cored; six kinds were used.

A rotating disc was arranged near the lens, to allow the beam to pass for about $\frac{1}{1000}$th of a second, and to be cut off for about $\frac{1}{100}$th of a second. It was then found that a bright patch, occupying about one-quarter of the crater, appeared to be rapidly revolving. Examination of the shape of this patch showed that it consisted of the bright spot already mentioned, and of a curved appendage which swept round, sometimes changing the direction of its rotation. This appendage seemed to be approximately equivalent to a quadrant sheared concentrically through 90°. Distinct variations in the luminosity of the crater are probably due to the fact that this is only an approximation.

The *a priori* theory of the constant temperature of the crater is so attractive that the author is inclined to attribute this phenomenon not to any actual change of the luminosity of the crater, or to any wandering of the luminous area, as is seen with a long, unsteady arc, but to the refraction of the light by heated vapour. All experiments, such as enclosing the arc in a small chamber of transparent mica, or the use of magnets, or an air blast, have failed to produce any effect. A distortion of the image of the crater while the patch revolves has been looked for, but nothing distinguishable from changes of luminosity has been seen.

An unexpected difficulty is thus introduced in the use of the arc as a standard of light, and one which may interfere with its use under some circumstances as a steady and continuous source of light. The author is further examining this phenomenon with the view of ascertaining its nature, and of finding practical conditions under which it is absent or negligible.

* J. Swinburne and S. P. Thompson, discussion on paper by the author, "Inst. Electrical Engineers," Vol. xxi., pp. 384 and 403.

† Abney and Festing, *Phil. Trans.*, 1881, p. 890; S. P. Thompson "Soc. Arts *Journ.*," Vol. xxxvii., p. 332.

NEW PATENTS—1894.

14,113. "Improvements in electric energy and power recording meters." A. G. Cooper. Dated July 23rd.

14,123. "Improved method of fixing electric bells and telephones." W. P. Theermann and G. C. Elliott. Dated July 23rd.

14,156. "Improvements in or connected with electrical waggons." O W. Ketchum. Dated July 23rd.

14,202. "Improvements in signalling by electric lamps." H. D. Fitzpatrick. (Communicated by the Boughton Telephotos Company, United States.) Dated July 24th. (*Complete.*)

14,240. "A new or improved electrical apparatus for calling or waking persons in different rooms at different determined times." W. Wilke. Dated July 24th. (*Complete.*)

14,246. "An improved system of electrical distribution by alternating currents." C. F. Scott. [Date applied for under Patents, &c., Act, 1883, Sec. 103, February 26th, 1894, being date of application in United States.] Dated July 24th. (*Complete.*)

14,290. "Improvements in electrical lamp holders and similar electrical fittings." G. Binswanger. Dated July 25th. (*Complete.*)

14,312. "Improvements in automatic switch devices for electric currents." J. T. Ashton. Dated July 25th.

14,320. "Improvements in dynamo-electric machines and electromotors." J. A. Kingdon. Dated July 25th.

14,394. "Improvements in induction coil apparatus for electro-medical and other purposes." H. J. Dale. Dated July 26th.

14,455. "An improvement in lightship connections for submarine cables." E. Templeton and H. P. Schischkar. Dated July 27th.

14,492. "An improvement in the chamber or reflector for carrying the lamps used in photographing by the electric light." A. G. Adamson. Dated July 28th.

14,493. "Improvements in apparatus for the use of electric light for photographic purposes." A. G. Adamson. Dated July 28th.

14,509. "Improvements in electric current regulators." H. V. Keeson. Dated July 28th.

14,533. "Improvements in apparatus for transforming electric currents." J. A. Fleming. Dated July 28th.

14,545. "Improvements in the construction of dynamo-electric machines and electromotors." T. Parker, Limited, and T. Parker. Dated July 28th.

14,546. "Electric contact by weight." S. David. Dated July 28th.

14,551. "Improvements relating to the transmission of signals through submarine cables and other telegraph and telephone lines and to apparatus therefor." D. Young. (Communicated by J. M McMahan, United States.) Dated July 28th.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1893.

8,881. "An improved automatic electric machine." A. Howard. Dated May 3rd. Has for its object the supplying of an electric shock in exchange for a suitable coin. 3 claims.

9,638. "Central office apparatus and circuits for telephone exchanges." E. J. Hall. (Under International Convention.) Dated October 13th. Comprises a division of the main switchboard into two distinct portions, one where calls are uniformly received and answered, containing the terminals of the lines with their spring-

jacks or other circuit connections, the annunciator drops and connecting appliances; and another on which all circuits are represented by circuit connecting appliances such as spring-jacks, and at which connections resulting from calls received at the first portion are effected with any desired circuit. 20 claims.

9,639. "Trunk-line signalling apparatus and circuit for telephone exchanges." E. J. Hall. (Under International Convention.) Dated October 13th. Consists chiefly in combining systems of divided switchboards, including their necessary connection devices and office trunk conductors with inter-station trunk conductors fitted with a reciprocal signalling system, whereby connections and disconnections at either end of said trunk may be indicated at the other, without the necessity of constructing special conductors for such signalling system. 11 claims.

9,640. "Electrical signalling apparatus and circuits." E. J. Hall and F. A. Pickernell. (Under International Convention.) Dated October 13th. Relates to call generators for telephone exchanges, to their circuits, and to devices for graduating, controlling and differentiating their currents. 9 claims.

9,753. "Improvements in electrical and other measuring instruments and apparatus." W. E. Ayrton and T. Mather. Dated May 16th. Consists in coating or preparing the glass front, shade, or other transparent substance through which the position of the working parts, pointer, or other indicating or recording mechanism or device is seen, so as to form a transparent, or nearly transparent, conducting, or partially conducting screen. 3 claims.

10,396. "Improvements relating to electric conductors. W. L. Dudgeon. (A communication by La Société Anonyme John Cockerill, of Belgium.) Dated May 26th. Relates to electric conductors for use in mines and other places containing explosive gases, where it is of great importance to guard against sparking. According to this invention the electric conducting cables are divided into sections joined together by means of couplings, so constructed, as to allow of the disconnection or rupture of the small or secondary wire of the cable long before the joint of the cable properly so called becomes broken. 3 claims.

11,728. "Improvements in switches for electric currents." E. F. Moy. Dated June 14th. For a single-pole switch, the inventor makes a special flat bridge piece, of a triangular form in its general outline, with a modified triangular shaped orifice through the central part of the bridge piece, and mount it at its apex upon a suitable pivot. The pivot is secured to a suitable base, in a convenient manner and the lower part of the bridge piece is arranged to carry one or more contact pieces, and is capable of a to and fro movement upon the arc of a circle. A stud is also mounted on the base in such a way as to occupy a central position with reference to the bridge piece, and passing through and extending above the orifice therein. This stud carries a crank arm actuated by a key or handle on the upper part of the stud, and it has a circular movement about, or nearly 108°. 5 claims.

11,759. "Improvements in or relating to electric bells." C. Turnbull, jun. Dated June 15th. Consists in a special arrangement or combination of parts having for its object an improved regulation or adjustment of the period of electrical contact whereby improved results may be obtained from the bell. 5 claims.

11,842. "Improvements connected with the insulation of electrical conductors." E. Payne. Dated June 16th. Claim:—In a system of electric conductors the combination of insulating jointing blocks, made in two or more parts, fitting over or around the conductors and provided with projecting portions fitting inside the ends of tubes or tubular casings enclosing the conductors, substantially as described with reference to the figures.

11,890. "Improvements relating to telephones." P. Rabbidge. Dated June 16th. The instrument consists of a transmitter and a receiver, which are rigidly connected together in such a manner that they may be used simultaneously. The receiver is also made to act as the alarm or call, and an automatic gravity switch is employed by which the various circuits are closed as and when required. 5 claims.

12,011. "Electric low-water alarm for steam boilers." R. Brown. Dated June 19th. By the higher temperature of steam, mercury is caused to rise, as to make contact with two wire-ends sealed in mercury tube, thereby connecting the two together, completing the electric circuit, causing the electric bell to ring so as to warn the attendant.

12,141. "Improvements in electrical time switches for signalling." E. Tyer. Dated June 20th. Relates to means of preventing electrical connection from being made until a certain time has elapsed after the greatest number of strokes required for any special signal may have been given. 2 claims.

12,437. "A mode of and means for electrically controlling lubricators." P. Rosling and F. J. A. Matthews. Dated June 24th. The valve or stopper of the lubricator is directly or otherwise connected with an electro-magnet in such a manner that the valve is moved towards its open position when the circuit is completed, by the attraction of the armature to the magnet; when the current is broken, and the armature falls away, the valve is again closed. 7 claims.

13,491. "Improvements in semaphore signal apparatus." Siemens Bros. & Co., Ltd. (Communicated from abroad by Messrs. Siemens and Halske, of Berlin.) Dated July 11th. The object of the present improvements in the actuating apparatus is, on the one hand, to obtain by suitable transmitting devices a sufficent reduction of the considerable force that is required for holding the semaphore arm in position, to enable such holding, as also the releasing to be effected with certainty by weak battery currents, and on the other hand, to avoid the severe shocks occurring on the resetting of the apparatus, which in the previous construction acted injuriously on the apparatus. 3 claims.

13,492. "Treadle apparatus for operating signals by means of passing trains. Siemens Bros. & Co., Ltd. (Communicated from abroad by Messrs. Siemens & Halske, of Berlin.) Dated July 11th. Relates to treadle apparatus situated at the side of a line of rails for operating signals by passing trains. According to the present invention, such treadles are so arranged as to effect a different operation, according to the direction in which the train passes over them. 3 claims.

13,996. "Improvements in vehicles and electric locomotives for single line elevated railways." F. B. Behr. Dated July 19th. Relates to the construction of vehicles and electric locomotives for a railway which has a single rail usually elevated on trestles, and lateral guide rails fixed on each side of the trestles, the vehicles being placed astraddle the rail and prevented from canting by horizontal wheels or rollers bearing on the guide rails. 5 claims.

14,472. "An improved switch for use in connection with shop door bell circuits and the like." J. Barkshire and E. Wright. Dated July 27th. Consists in the arrangement of a switch that is placed to act in connection with a door, and having this advantage over the old form, viz., that the circuit cannot be left open by an omission when the attendant leaves the shop or office, as it immediately closes when the place is left. 1 claim.

15,669. "Apparatus for the electrolytic treatment of liquids." N. Browne. (Communicated by A. Vogelsang, of Dresden.) Dated August 18th. This apparatus for the electrolytic treatment of liquids is designed with a view of exposing the liquid to be treated to as large a number of electrodes as possible in a small space, and of permitting the apparatus to be readily cleaned. 1 claim.

15,715. "Improvements in or connected with means for the supply or distribution of electricity." W. G. Little and C. W. G. Little. Dated August 18th. The generator which supplies the mains is supplemented by a generator to such an extent, that they between them give a current of sufficient intensity to charge the accumulators, with which both they and the mains are in connection. The windings and connections of the field magnets of the dynamos are so arranged that when the main circuit is open the two dynamos can charge the accumulators, but when the mains are closed and the work therein renders it necessary that the accumulators supply current thereto, current passes through the windings of the field magnets of the supplementary dynamo in a direction to lessen the magnetic field of that dynamo, so that the accumulators can discharge into the mains, or in place of this the current in the mains may be made to raise the potential of the supplementary dynamo, which is then so arranged that it is used to assist the discharge of the accumulators, in which case a less number of cells in the accumulators can be employed. 2 claims.

16,074. "Improvements in apparatus for lighting gas by electricity." A. Geyer and J. Stegmeier. Dated August 25th. Relates to an apparatus in which gas is lit by electric sparks. 6 claims.

16,136. "Improvements in or relating to electrodes for primary and secondary batteries." A. J. Boult. (A communication from R. T. E. Hensel, of Dresden.) Dated August 26th. Relates to the production of electrodes for primary and secondary batteries which require no separate core for the active mass, nor any internal conductor, and consist entirely of active metallic salts or oxides with or without the addition of suitable cementing agents. 3 claims.

20,381. "Improvements in joints for electric light fittings." E. A. Claremont. Dated October 28th. In electric light fittings the use of a joint in or through which to lay or pass a wire or wires employed in connection with electric work, and constructed in the manner and for the purpose substantially as described.

20,887. "Improvements in incandescent lamps." A. S. Ford and W. Barnes. Dated November 3rd. Provides a means whereby objectional "glare" is removed, without involving any appreciable loss of light. 7 claims.

21,379. "Improvements in the application of electric light for photographic purposes." A. G. Adamson. Dated November 10th. The inventor provides a resistance coil through which the current passes to the lamp, and at the instant of exposing the plate he switches out the resistance and obtains the bright light for a few seconds, during which the photograph is being taken. 1 claim.

22,863. "Improvements in the regulation of dynamo-electric machines and other electrical apparatus." H. H. Lake. (Communicated from abroad by the Thomson-Houston International Electric Company, of America.) Dated November 28th. The series turns of machines running in multiple arc are divided into two or more sections, part of which are always in the main circuit and are not varied by shunting, while around the remainder a variable shunt is provided, whereby in each machine the total influence of the different sections of the series coil may be varied by a proper variation of one such section. 16 claims.

22,912. "Improvements in electrodes and cells for secondary batteries or accumulators." E. H. Wheeler. Dated November 29th. Consists of a grooved cell combined with a hollow plate or grid which is calculated to be better and more durable than secondary batteries or accumulators heretofore employed. The plate is hollow and made of lead, or an alloy of lead, and may be either cast or stamped in two separate parts and afterwards joined together, and being held in their respective positions by grooves manufactured in the cells to suit their sizes, and being made of non-conductive material. 4 claims.